The New Zealand
Journal of Agriculture.

VOL. 54. WELLINGTON, 20TH MARCH, 1937. No. 3.

PEA-MOSAIC.

ITS SYMPTOMS, ECONOMIC SIGNIFICANCE, AND PREVENTIVE TREATMENT.

E. E. CHAMBERLAIN, Plant Diseases Division, Plant Research Bureau, Palmerston North.

OF the many virus diseases which have been recognized in New Zealand during the past few years pea-mosaic is one of the most common. This disease occurs throughout both North and South Islands, and its incidence appears to be increasing. It is of world-wide distribution, having been recorded from Europe, North America, South America, and Japan.

HOST-RANGE.

The host-range of pea-mosaic in New Zealand has already been discussed (Chamberlain, 1936). It occurs in the field on garden and field peas, blue lupins, red clover, broad beans, and sweet peas.

SYMPTOMS.

Garden Peas (Green Feast variety).—The first symptom of the disease occurs on the young leaves, where the appearance of light-coloured areas along the veins produces a net-work type of mottling (Fig. 1B). Later symptoms consist of a more generalized mottling (Fig. 1A). In some varieties, such as Yorkshire Hero, the mottling may become much more pronounced, the light and dark green areas being larger than those on Green Feast and the leaves distorted (Fig. 2). Infected plants are stunted (Fig. 3) and usually paler in colour than healthy plants. They flower later and produce fewer pods, which are smaller, less well filled, and mature more slowly than those of healthy plants (Fig. 4).

In certain late varieties of luxuriant growth the internodes are considerably shortened, thus producing a more marked stunting of the plants.

The symptoms on field peas are similar to those on garden peas.

Blue Lupins.—The symptoms on this host have been given in detail elsewhere (Neill, Brien, and Chamberlain, 1934). In brief, they are: Curling-over of the growing-point, cessation of growth, browning of the stem, wilting of the young leaves, and, finally, death of the plant.

Red Clover.—The characteristic symptom is a mottling of the leaves. This mottling is produced by the occurrence of light-coloured streaks which follow the direction of the veins (Fig. 5). Infected plants are pale in colour and often much stunted (Fig. 6).

Broad Beans (Exhibition Long Pod variety).—As with peas, the first symptom is the appearance of light-coloured areas along the veins of the young leaves, these being replaced later by a more general type of mottling (Fig. 7). Infected plants are stunted and are paler in colour than healthy plants. The pods do not set freely and are small in size, with the result that the yield is considerably reduced.

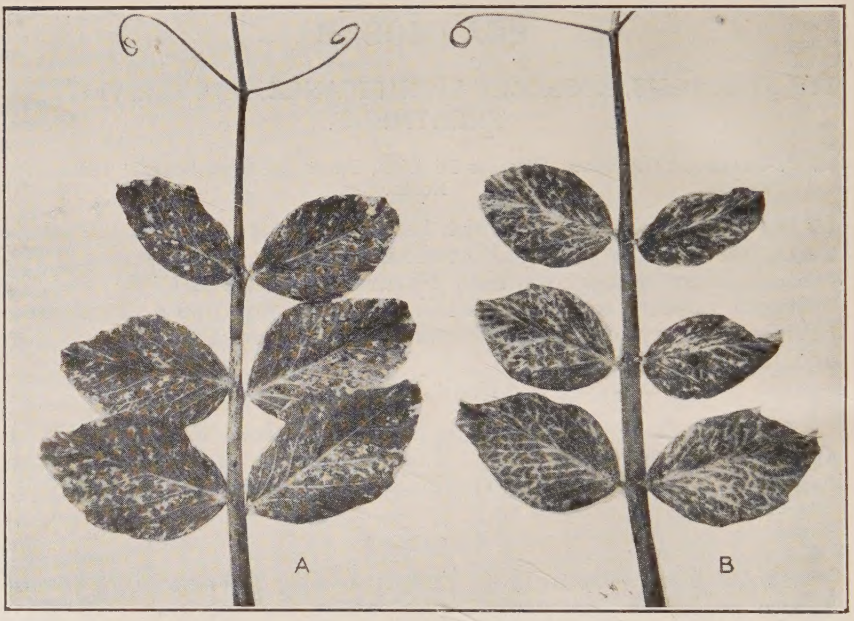


FIG. 1. PEA-MOSAIC. LEAVES FROM INFECTED GREEN FEAST GARDEN PEAS.
A. Showing ordinary mosaic mottling. B. Showing early symptoms of the disease.
[*Photo by H. Drake.*

Sweet Peas.—Here again the characteristic symptom is a mottling of the leaves (Fig. 8). Neither the growth of the plant nor the number of flowers produced appears to be greatly affected. The flowers show, however, a definite streaking (Fig. 9), similar in nature to "breaking" in tulips.

INCIDENCE.

Peas.—Although the occurrence of mosaic on peas is general throughout New Zealand, it has become of economic significance only in certain localities. Of these, the seed-growing district of Marlborough is the most important. An inspection during the last season of a number of crops in the vicinity of Blenheim showed that (with the exception of certain apparently immune varieties) a high percentage of mosaic

occurred on both garden and field peas. In every crop examined infection was greater near the outside of the field than in the centre. Thus some crops showed an infection of approximately 20 per cent. near the headlands and as low as 5 per cent. in the centre of the crop, while others showed approximately 50 per cent. near the outside and 15 per cent. in the centre.

FIG. 2. PEA-MOSAIC. PRONOUNCED MOTTLING OF LEAF OF YORKSHIRE HERO GARDEN PEA.
[*Photo by H. Drake.*

In the Manawatu district pea crops occasionally become severely infected, and small areas have shown an infection as high as 90 per cent.

Blue Lupins.—The incidence of the disease appears to be even greater on blue lupins than on peas. Its economic significance has been dealt with already (discussed under the name of "sore-shin"—Neill, Brien, and Chamberlain, 1934).

Red Clover.—Under ordinary cultivation red-clover crops do not appear to develop a high percentage of infection. Thus in crops near Blenheim it was difficult to find infected plants. Along the headlands and roadsides, however, the percentage infection was much higher, and the plants along three to four miles of roadside inspected showed approximately 20-per-cent. infection.

At the Plant Research Bureau, Palmerston North, mosaic on single-plant selections has caused a great deal of trouble to the agrostologists. Single plants over a period of two seasons become infected to the extent of almost 100 per cent.

FIG. 3. STUNTING CAUSED BY PEA-MOSAIC ON GREEN FEAST GARDEN PEAS, GROWN IN THE GLASSHOUSE. HEALTHY PLANTS ON RIGHT.

[*Photo by H. Drake.*

Broad Beans and *sweet peas* are commonly infected, but the disease is scarcely of economic significance on the latter.

Effect on Yield of Garden Peas.

Some idea of the effect of pea-mosaic on yield may be obtained from Fig. 4. Several attempts to determine the actual reduction in yield have failed, because in each case the disease spread to the check plants.

During the 1935–36 season a small-scale yield trial was obtained by marking, in a block showing a small percentage of the disease, each

mosaic-infected plant, together with a healthy plant adjacent to it. These plants were harvested separately and the weight of seed taken. The results are given in Table I.

Table I.—Effect of Pea-mosaic on Yield of Garden Peas (Yorkshire Hero Variety).

Plant No.	Weight of Seed.	
	Healthy.	Mosaic infected.
	Grammes.	Grammes.
1	10·05	3·89
2	12·40	3·72
3	7·42	4·52
4	10·83	6·84
5	11·97	3·32
6	14·84	4·94
7	9·85	7·95
8	3·15	4·10
9	8·11	4·63
10	7·50	4·32
11	10·15	7·51
12	8·36	4·22
Total ..	114·63	59·96

The reduction in yield amounted to 47·7 per cent.

The crop was poor owing to unfavourable weather conditions, and the yield from individual plants was further lessened by close planting.

Methods of Spread and Overwintering.

It has already been shown (Chamberlain, 1936) that pea-mosaic may be transmitted by artificial inoculation with expressed juice. Such transmission, however, is difficult to secure, and it is improbable that the disease would be spread by handling the crop.

Pea-mosaic is readily transmitted by means of insects. In this country it has been found that the aphides *Myzus persicae*, *Aphis rumicis*, and *Macrosiphum gei* are able to transmit the disease (Chamberlain, 1936). All three aphides occur commonly on peas.

In New Zealand no transmission of pea-mosaic has been secured through the seed of peas, blue lupins, red clover, or broad beans (Chamberlain, 1936).

Thus it would appear that under natural conditions spread is effected by insects. Since peas, blue lupins, broad beans, and sweet peas are all annuals initial infection must take place from some outside source, and the most obvious source is red clover.

In the United States of America Davis (1915) found that the pea-aphis (*Macrosiphum pisi*) overwintered on red clover and migrated to other legumes in the spring and summer. In New Zealand *Myzus persicae* and *Macrosiphum gei* infest red clover, and it would appear that they overwinter on this host. Any of these aphides which have overwintered on mosaic-infected red clover would carry infection with them

when they migrated to other legumes in the spring or summer. That such occurs is suggested by observations made at the Plant Research Bureau.

All plantings of red clover made at the Bureau Area within the last five years have developed a high percentage of mosaic, and all crops of garden peas, blue lupins, or broad beans grown in their vicinity (within 4 chains) have become severely infected with the disease. In the spring of 1934 Green Feast garden peas and blue lupins planted within 1 chain of a block of mosaic-infected red-clover plants developed 89·5 and 93 per cent. of the disease respectively. Green Feast peas grown on another

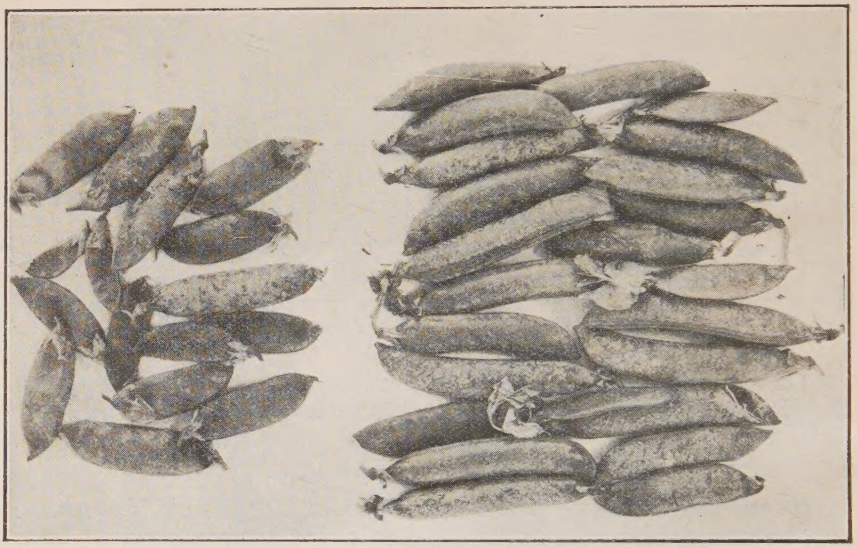


FIG. 4. EFFECT OF PEA-MOSAIC ON YIELD OF GREEN FEAST GARDEN PEAS.
The pods on the left are the yield of a single infected plant, while those on the right are from a single healthy plant.
[*Photo by H. Drake.*

portion of the farm (over 10 chains distance) developed approximately 0·25 per cent. mosaic, and blue lupins grown at a similar distance from the red clover showed an infection of about the same order.

In Marlborough it appears that the disease spreads to the pea crops from infected red-clover plants growing along the headlands and roadsides.

Immune Varieties.

During the spring of 1933 a block of ten varieties of garden peas were grown at the Plant Research Bureau. The varieties grown were Green Feast, Great Crop, Pioneer, Lord Chancellor, Medium Straw Daisy, Gladiator, Admiral Beatty, Pride of the Market, Prince of Wales, and Little Marvel. To ensure development of mosaic, aphides from infected plants were distributed through the crop. All varieties except Lord Chancellor and Little Marvel developed a high percentage of mosaic.

These two varieties were grown the following season adjacent to Green Feast peas in a block within 1 chain of an area of mosaic-infected red clover. Of the 525 plants of Green Feast peas grown 89·5 per cent. developed mosaic, while the 349 Lord Chancellor and the 578 Little Marvel plants remained healthy.

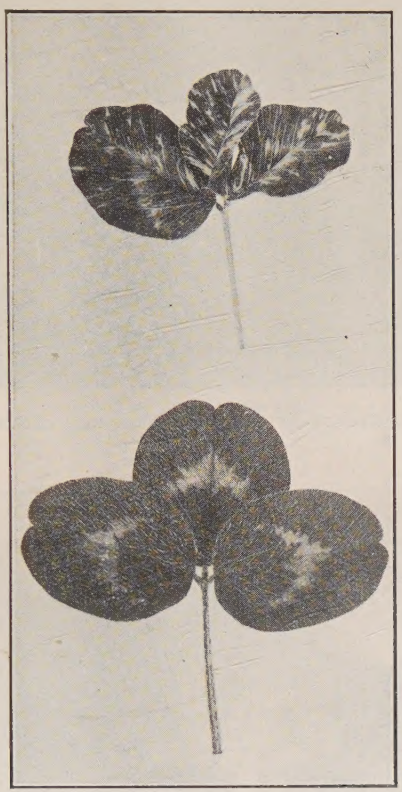


FIG. 5. THE EFFECT OF PEA-MOSAIC ON THE LEAVES OF RED CLOVER. LEAF FROM HEALTHY PLANT AT BOTTOM.
[*Photo by H Drake.*

The immunity of these two varieties was also tested in the glasshouse, where an attempt was made under controlled conditions to transmit mosaic to them by means of aphides. The results of these experiments are given in Table II.

Table II.—Determination of Varietal Immunity of Peas to Pea-mosaic.

Date of Inoculation.	Variety.	Species of Aphis.	Number of Aphides.	Number of Plants inoculated.	Number of Plants infected.
25th January, 1935..	Green Feast ..	*Aphis rumicis*	12	15	5
,, ..	Lord Chancellor	,,	12	15	0
,, ..	Little Marvel ..	,,	12	15	0
11th March, 1935 ..	Green Feast ..	,,	10	20	11
,, ..	Lord Chancellor	,,	10	20	0
,, ..	Little Marvel ..	,,	10	20	0

Both field and glasshouse experiments indicate that Lord Chancellor and Little Marvel peas are either immune or highly resistant to pea-mosaic. Observations made in the field both at Palmerston North and

FIG. 6. THE STUNTING EFFECT OF PEA-MOSAIC ON RED CLOVER. HEALTHY PLANT ON RIGHT.

[*Photo by H. Drake.*

FIG. 7. MOTTLING OF BROAD BEAN LEAF CAUSED BY PEA-MOSAIC. LEAF FROM HEALTHY PLANT ON RIGHT.

[*Photo by H. Drake.*

Blenheim suggest that there are certain other varieties which do not develop mosaic, and experiments are being carried out to test for immunity the more commonly grown pea varieties in New Zealand.

Preventive Measures.

Experiments carried out at the Plant Research Bureau have shown that spraying to destroy insects does not give an effective control of pea-mosaic.

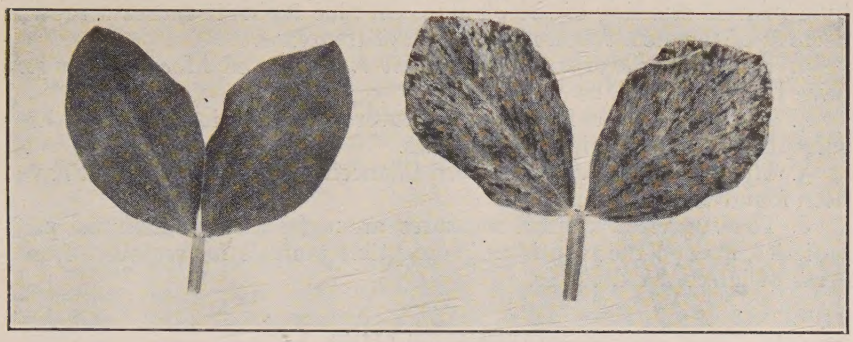


FIG. 8. MOTTLING OF SWEET-PEA LEAF CAUSED BY PEA-MOSAIC. LEAF FROM HEALTHY PLANT ON LEFT.

[*Photo by H. Drake.*

FIG. 9. STREAKING OF SWEET-PEA FLOWERS CAUSED BY PEA-MOSAIC. FLOWER FROM HEALTHY PLANT ON LEFT.

[*Photo by H. Drake.*

Alternative methods are (*a*) the growing of susceptible crops as far removed as possible from areas of infected red clover, and (*b*) for peas, the use of immune varieties.

SUMMARY.

1. Pea-mosaic, a virus disease of garden and field peas, blue lupins, red clover, broad beans, and sweet peas, is prevalent throughout New Zealand.

2. On peas, red clover, broad beans, and sweet peas it causes a mosaic mottling of the foliage, accompanied, in the case of the first three hosts, by a marked stunting of the plants. On blue lupins it causes a brown necrosis of the stem followed by death of the plant.

3. The aphides *Myzus persicae*, *Aphis rumicis*, and *Macrosiphum gei* have been shown to be vectors.

4. The disease overwinters on red-clover plants and is spread to other susceptible hosts by migrating aphides.

5. The garden-pea varieties Lord Chancellor and Little Marvel have been found to be immune.

6. The suggested control measures are: (*a*) Use of immune pea varieties, and (*b*) the planting of susceptible annuals far removed from areas of infected red clover.

LITERATURE CITED.

CHAMBERLAIN, E. E. (1935): *N.Z. Journ. of Agric.*, Vol. 51, pp. 86–92.
——— (1936): *N.Z. Journ. of Sci. & Tech.*, Vol. 18, pp. 544–556.
DAVIS, J. J. (1915): *U.S. Dept. of Agric. Bull. 276*, 67 pp.
NEILL, J. C.; BRIEN, R. M.; and CHAMBERLAIN, E. E. (1934): *N.Z. Journ. of Agric.*, Vol. 49, pp. 139–146.

NEW PERMANENT PASTURE AS GREEN-FEED IN CANTERBURY.

A. H. FLAY and C. P. TEBB, Canterbury Agricultural College, Lincoln.

THE Canterbury farmer depends upon supplementary green-feeds as part of the diet of sheep and dairy cows. A low and uncertain rainfall necessitates the use of such feeds in dry autumns for maintaining the milk-production of cows and for the flushing of ewes. Green-feed for lambing is a well recognized essential, especially on medium and light lands. The actual extent to which the farmer is dependent upon such feeds is seldom realized fully until the occurrence of a very dry period. For instance, the low lambing-percentages and high mortality in the spring of 1933 can be attributed in general to defective or unbalanced nutrition arising from feed-shortage. This feed-shortage occurred in the spring and autumn of that year. Both seasons were dry, and supplementary green-feed crops were very much reduced in production. Had there been ample and better-balanced green-feeds or abundance of freshly grown grass, as occurs in seasons of high rainfall, for autumn and spring flushing and for lambing, more lambs would have been born and more would have survived.

Many Canterbury farmers summer-fallow a paddock which is sown to Italian rye-grass in February for the purpose of providing a large volume of green-feed at the appropriate seasons. The fallow-period may extend from the time turnips are eaten off—about the end of September—to sowing-time in early February, a four months' fallow. The

aim is usually a two or three months' fallow-period. Where oats are sown for green-feed, often the fallow-period, especially on the lighter soils, occupies two months. Although under many systems of farm-management it would be difficult to do away with such green-feeds, it is well recognized that their cost of production is high when considered on a food-unit basis. The question may well be asked, then, if green-feed could be provided in any cheaper manner and, if in the establishment of permanent pasture on soil fallowed as for Italian rye-grass, sufficient green-feed could not thereby be provided so that ordinary temporary green-feeds may be largely dispensed with, or, at least, reduced in area with advantage. It is the object of this article to discuss this question and to show that new permanent grass can provide at least a part of the green-feed ration.

Green-feed Crops: Method of Growing, Uses, etc.

Green-feed is usually provided by such crops as oats, barley, Italian rye-grass, kale, rape, and sometimes turnip-tops. Oats and Italian rye-grass form the main spring green-feeds, while these and others mentioned are used for flushing and for late-autumn feed. Turnips, as well as providing the bulk of the winter feed, often provide the very early spring supplementary feed, especially along the foothills.

On many farms green-feed oats or barley are sown after a grain crop. Under these circumstances, except on the best soils, little autumn feed is secured. Fair grazing is provided in the spring. If these crops are sown in February on land fallowed from December or earlier, then very good production is obtained in autumn, winter, and spring. Italian rye-grass is generally sown in January or February after a fallow, or it may be sown in February or March following a grain crop. It provides a bulk of feed in the late autumn, some winter feed, and good spring feed. Part or all of it, on good land, may be shut up in the late spring for seed-production.

When green-feed oats or Italian rye-grass are grown purely for green-feed, the cost per food-unit, or per sheep-week of grazing, is high. If seed-production or a chaff crop can also be secured the cost may be kept low, and this can be, and usually is, done on the better classes of land. On the medium and light lands, however, where the growing of large areas of green crops is the general practice, green-feed and a cash crop cannot be secured satisfactorily or profitably from the same sowing.

Present Method of sowing Grass.

In spring and summer many farmers sow grass with turnips, kale, or rape, and with oats in the autumn. The threefold object in adopting this procedure is to obtain (1) a better-balanced supplementary feed; (2) cheap sowing; and (3) a permanent pasture following the supplementary crop without the necessity of further tillage. Although a thin and open sward usually results from this method of sowing, in a normal season on light land the first object is generally achieved. The second, cheap sowing, may prove to be false economy, however, when the weed-invasion and lowered production resulting from the bare spaces of such a pasture are considered over a period of years. So far as a permanent pasture is concerned this object is at the best, only partially achieved

by the production of a poor pasture for a few years. On heavy land the supplementary crop, if as good as it should be, often smothers the young establishing pasture to a large extent.

In either case, the young grass is severely treated by (1) the heavy tramping in autumn and winter when the higher yielding crop is being grazed, and (2) the severe grazing of rape and kale at an early stage and during dry weather. In connection with the latter consideration it is characteristic of sheep to eat out the lesser constituent before turning to the more bulky crop. With normal seedings for the supplementary crops this lesser constituent is nearly always the pasture. The supplementary crop also uses a portion of the fertilizer which might be available to the pasture-plants.

In general, the practice of sowing permanent pastures along with a supplementary feed crop is unsatisfactory. Because of the smothering and the early severe grazing, often little autumn, winter, or lambing green-feed is obtained from the new pastures sown down with these supplementary crops.

Establishment of Permanent Pasture.

From the point of view of season and fallow, permanent pasture sown alone on a firm seed-bed could be established in the place of any of the crops that have been under discussion above. The only exception to this is that first-class permanent pastures rarely can be established in the autumn following a grain crop, though fair green-feed oats can be grown.

The best method(1) of permanent-pasture establishment, whether it be on heavy or light land, is that of sowing a suitable mixture of truly perennial strains alone on a properly prepared and well-fallowed seed-bed. The length of time between the original ploughing and the sowing should not be less than three months. Deep cultivation should be completed at least six weeks before the intended sowing-date, and the final period should be filled in with surface-working only—that is, suitable light harrowing and rolling that result in moisture-conservation and weed-control, and leave, ultimately, a fine, firm, moist, weed-free seed-bed. Sowing a pasture under such conditions in October or November, on almost any soil, gives a good germination, a rapid establishment, and a complete cover. Where annual weeds such as fat-hen and spurrey are excessively troublesome early autumn (February) sowing is quite satisfactory. If properly regulated grazing is maintained, particularly in the first year, a good permanent pasture is assured. The new pasture provides luscious grazing as green-feed as soon as it is several inches high.

Seed-mixture.

The seed-mixture which is recommended for maximum green-feed production and a permanent pasture, and which can be grazed in a hard manner for a short time if absolutely necessary, is the dominant-rye-grass type as follows:—

	Pounds per Acre.
True or certified perennial rye-grass	30 to 35
Akaroa cocksfoot	5 to 7
Montgomeryshire red clover	3 to 4
Wild or certified white clover	1 to 2

(1) *New Zealand Journal of Agriculture*, September, 1933, pp. 176–180.

On heavy land cocksfoot may be omitted from this mixture, and on light or poor land subterranean clover at 1 lb. to 2 lb. per acre should be included. At present-day prices this mixture costs 18s. to 24s., say, £1 per acre. To those accustomed to sowing temporary strains of seed this cost may seem excessive. That this is not so, however, may be appreciated by the long-term view being taken: the cultivation costs are no more for the establishment of this permanent pasture than for the proper sowing of a temporary pasture.

As against green-feed alone, the cost may appear even more excessive, but it is easily offset by the cultivation, seeding, and manuring costs of green-feed production over a period of, say, five years, during the whole of which time the one permanent pasture is involving no other expenditure than that of annual top-dressing.

Time to sow Permanent Pasture for Maximum Green-feed Production.

The establishment of good rye-grass pasture may be obtained by autumn sowing, and on heavy land in a high state of fertility early autumn sowing of cocksfoot and clovers may be highly successful. Because of better weed-control, early autumn or summer sowing on heavy or weed-infested land is preferred. The degree of success, although dependent upon the weather experienced at and after sowing, varies with the length of fallow and fitness of the seed-bed. These pastures usually give late autumn green-feed for fattening late lambs, for flushing of ewes, and abundant spring green-feed. It would probably be April, at the earliest, before grazing could be commenced—assuming a February sowing. Sowing should generally take place in February, and certainly not later than the end of March.

On the medium and light land spring and early summer sowings are not affected, as a rule, by the annual weeds that are troublesome on the heavy lands. Along the foothills of Canterbury, however, spurrey (or yarr) may be troublesome in certain areas. Although December sowing is desirable on these foothill lands, January and February sowings on well-fallowed land make a rapid and thorough establishment, on account of the favourable rainfall that generally occurs. On these areas extremely good pastures have also been obtained by sowing alone in November and December on well-fallowed land after turnips.

On every class of land the earlier the sowing can take place the longer will be the green-feed season. On light land, pasture sown at the end of September should be ready for grazing in December. According to the conditions of rainfall and fertility such a pasture will give green-feed throughout the autumn and up to October of the following spring.

Regardless of the time of sowing, the green-feed value of the pasture disappears with the approach of November, about thirteen months after spring sowings and eight months after autumn sowings, because, firstly, the rye-grass (especially on lighter soils) tends to shoot rapidly to seed at this time, and, secondly, there is usually adequate feed from the other grazing pastures.

In general, and especially on medium and light land, spring and early summer sowings are the best for securing maximum green-feed and a good mixed pasture, and should be the aim wherever tillage and weed conditions will permit.

Uses and Management of New Permanent Pasture.

In a season of average rainfall a new permanent pasture of the type described, and sown in October or November as indicated, should be ready for a light grazing in the latter part of January or the beginning of February. Throughout the autumn, provided that rainfall is adequate and nor'westers are not too frequent, such a pasture provides useful green-feed, and if reserved for special purposes such as lamb-fattening or flushing of ewes and rams allows a reduction in area of feeds grown for these purposes.

It has been found that such a pasture on medium land, throughout the autumn period, fattens five or more lambs per acre without supplementary hand-feeding. With ½ lb. wheat per lamb daily, eight to ten lambs per acre have been fattened. With a very light seeding of ½ lb. rape per acre on this class of land eight to ten lambs per acre have been fattened, and it has been found that this thin supplementary crop does not, with proper grazing-management, harm the new permanent pasture. The fattening-period should not occupy longer than two to three months.

By spelling the new pasture depending upon the use to which it is to be put, late autumn feed, some winter feed, and spring lambing-feed can be obtained. Except in the case of fattening lambs or cull ewes, this pasture should, of course, be rationed at the rate of two or more hours per day as is good practice with green-feeds.

In the spring ewes and lambs should be put on in groups of several days lambing, or mobs of ewes and lambs may be put on breaks for several hours daily. At no time should the pasture be subjected to hard grazing for a lengthy period. This is important, particularly if the cocksfoot and clovers are to be given a fair start.

The permanent pasture sown in October, November, or December under average-rainfall conditions assists in the provision of the following: lamb-fattening feed, flushing feed, late-autumn feed, some winter green-feed, spring flushing-feed, and lambing-feed up to October or November following sowing. At this time the rye-grass begins to shoot to seed, and the whole or part of such a pasture may be shut up for a profitable seed-crop. If a high yield of easily cut seed is desired, shutting up at the end of September for medium and light land and the middle or end of October for medium to heavy land is necessary.

If not used for seed-production, the pasture may be grazed in the usual manner throughout the spring. Under ordinary grazing-conditions a payable yield of seed may be obtained by means of stripping.

Gentle or light grazing from October onwards allows the cocksfoot and clovers to recover after the closer grazing during lambing. By spelling the pasture from mid-November to about the end of December, a bulk of succulent grazing may then be obtained from the clover in the sward in late December and January at a time when it is most valuable for maintaining ewes and lambs in a thriving condition.

The rye-grass that shoots to seed during this "spelling" period, even if it is not stripped, need not cause any concern, because under Canterbury conditions, if the pasture and stock are to receive the best treatment, and if fat-lamb production is the object, some seed-stalks cannot be avoided—even with continuous grazing. If grazing in the first year is hard enough to prevent the growth of seed-stalks, then cocksfoot and clover development is very poor, the value of the pasture in January and February is lost, and fat-lamb production is proportionately retarded.

Carrying-capacities of New Permanent Pastures used as Green-feed.

Although there are no comparative figures for green-feed oats, Italian rye-grass, and new permanent pastures grown under experimental and exactly similar conditions, yet records have been kept of the grazing obtained from new permanent pasture when grazed as though it were green-feed. A few representative figures are given in the following table:—

Table I. — Carrying-capacity of New Permanent Pastures when grazed as Green-feed: Dry Sheep or Ewes per Acre, by Months.

Locality.	Light Land (Plains).	Light Land (Foothills).	Medium Land (Foothills).		Medium-heavy Land (Plains).
Grass sown.	November, 1932.	November, 1933.	November, 1933.	December, 1933.	November, 1933.
January	Very dry Autumn.	Wet Autumn. ..	7·63	..	7·12
February		7·96	14·50	..	12·01
March		4·60	9·20	2·20	3·68
April		3·81	8·96	5·30	3·85
May		3·05	3·59	5·60	3·66
June		2·31	..	2·73	1·06
July	0·13	0·91	..		..
August	0·62	1·84	..		..
September	3·81	3·02	0·07		Shut seed
October	3·29	9·06	5·20	No records	lodged, and
November	3·47	6·93	2·30	kept.	only 20
December	1·35	2·84	1·40		bushels per acre saved.

Records have also been kept of the grazing obtained from green-feed oats and from Italian rye-grass whenever opportunity permitted. Some of these figures are given below:—

Table II.—Carrying-capacity of Green-feed Oats and Italian Rye-grass when used as Green-feed: Dry Sheep or Ewes per Acre, by Months.

Locality.	Green-feed Oats.			Italian Rye-grass.	
	Light Land (Plains).	Light Land (Plains).	Medium-heavy Land (Plains).	Light Land (Plains).	Heavy Land (Plains).
Sown.	January, 1930.	March, 1934.	February, 1932.	February, 1930.	February, 1930.
March	0·86	..	..	..	..
April	9·28	0·11	..	0·81	1·13
May	..	3·18	0·34	2·10	2·14
June	..	1·15	1·95	0·10	3·36
July	..	0·73	9·65	0·14	0·14
August ..	0·32	0·95	0·07	0·23	2·12
September ..	3·76	3·94	0·07	4·28	3·58
October ..	2·60	4·23	8·77	3·45	5·34
November ..	2·50	4·48	2·97	2·84	2·58
December ..	..	4·71	2·81	2·28	Yielded 49
January ..	..	2·18	..	?	bushels per acre
February ..	..	..	..	?	7·60

It is not intended that these tables should be taken as truly comparative of the grazing-capacity of new permanent pasture as against that of green-feed, nor should it be imagined that an attempt has been made

to prove that new permanent pasture when properly sown can equal during its first year the production from similarly sown Italian rye-grass. But the figures do indicate that new permanent pasture sown alone, in the fashion outlined, is capable, under ordinary circumstances, of giving satisfactorily high grazing when used as green-feed. It should be stated that the examples recorded above have been used because the methods of tillage and seed-bed preparation and the grazing procedure were under close observation, and are known to have been most satisfactory.

Conclusion.

Where permanent pastures are desired, whether it be on light or heavy land farms, the method of establishment and grazing-management as outlined is economically applicable to at least one paddock each year.

Such a practice allows some reduction at least in the area of costly temporary feeds; on account of the method and time of sowing, successful establishment is almost certain; by correct management valuable feed is obtainable at every special "green-feed" season for a period of approximately one year; the production of a valuable strain of seed is possible in the first harvest year if desired, but otherwise in later years; and, finally, a truly permanent first-class pasture is established. This last consideration, on all farms except those of the dominantly cropping type, and they are few, cannot help but appeal to the farmer who has tried the method thoroughly.

This method of establishing and managing new permanent pasture has become a definite part of a profitable programme on a large number of Canterbury farms.

BACTERIOLOGICAL EXAMINATION OF EXPORT BUTTER.

G. M. Moir and R. R. Russell, Dairy Laboratory, Wallaceville.

A survey of the literature dealing with the bacteriological content of butter gives a rather confusing impression. On one hand many butters containing large numbers of bacteria are classed as superior by those best qualified to judge, while on the other hand lower-grade samples have frequently been found to contain comparatively few organisms. The tendency for some years has been to devote most time to determinations of the yeast (and mould) content of butter, as these are held to provide a good indication of the sanitary conditions in the factory. On the other hand, few yeasts appear to be capable of actually spoiling butter, while small numbers of lipolytic (fat-spoiling) bacteria may do serious damage by actually decomposing the butterfat. Proteolytic types may also decompose the curd, and some of the lipolytic germs are said to be potent also in this respect. It is conceivable that a butter may be seriously infected with other organisms than yeasts, so that, if a yeast count alone is relied upon to indicate factory conditions, some cases of bad contamination may be overlooked. Counts of other organisms besides yeasts seem, therefore, to be necessary.

In order to deal with large numbers of samples, simplified methods are essential. Barkworth(1) has reported favourably on Van Oijen's modification of the Frost Little Plate method as a quick and economical

method for examining clean milk. For rapid determinations of the yeast and mould content of butter Johns(2) has also devised a modification of the Frost method, which he called the microplate method. This we have further adapted, so that by the use of different media, various counts may be made rapidly. Such counts include total agar count, yeast and mould count, count of fat-splitting germs (as indicated by nile blue sulphate agar), and count of heat-resistant germs. The coliform content has also been estimated by the method suggested by Grimes(3). The reliability of the microplate counts has been checked by comparisons upon eighty-four samples, for which, in addition, the usual Petri-plate methods were employed. Satisfactory agreement of lower counts was observed by the two methods, including the majority of the yeasts and fat-spoiling types. The total agar counts also gave reasonable agreement in most cases, but there was a tendency for the Petri-plate figure to exceed the microplate figure as the total increased. This was perhaps due to the effect of crowding on the microplate. However, the few occasions on which they differed appreciably were of no significance, as both counts were still high or low, and no case occurred of a high count on one and a low count on the other.

On account of the saving of time especially (as well as of material), these methods have enabled much larger numbers of samples to be examined than the usual Petri-plate method would have allowed. During the 1935–36 season the bacteriological condition of over 370 samples of salted butter passing through the Auckland Grading Store was determined at the Wallaceville Dairy Laboratory. The following is a summary of the results obtained during the period from 22nd November, 1935, to 6th August, 1936, inclusive :—

	Number of Samples.	Percentage of Total.
Agar counts per gram—		
Under 10,000	137	37
10,000 to 50,000	167	45
50,000 to 100,000	16	4
Over 100,000	50	14
Fat-destroying germs per gram—		
Up to and including 100	243	66
100 to 1,000	84	11
Over 1,000	42	23
Yeast counts per gram—		
Up to and including 100	82	22
100 to 1,000	203	55
Over 1,000	87	23
Coliform germs per gram—		
Absent	184	51
Trace	51	14
Present	86	24
Many present	41	11

The significance of the various counts can be explained in a broad sense as follows :—

The agar count is an indication of the total number of bacteria present, *excluding* lactic streptococci (" starter " bacteria). The culture media used is made up in such a way that the growth of this type is discouraged owing to the absence of milk sugar. The count of fat-destroying germs is perhaps the most important, as practically all these

germs are capable of producing bad flavours in butter. The yeast count and also the coliform content give an indication of the bacteriological state of the factory equipment, particularly of the churns, as these types are among the most easily destroyed by heat. The types which have been called "heat resistant" consist chiefly of yellow cocci such as are frequently found upon dairy equipment in deposits of slime and milk stone, which are located in pockets such that they escape the usual washing processes. Regular and thorough washing followed by steam sterilizing is necessary to avoid them. In many cases such heat-resistant types amount to a large proportion of the total count. The method of estimating this type proved in practice to be less reliable than the other methods. A longer time of incubation usually increased the figure, but, in the case of samples with high agar counts, the heat-resistant types failed to develop their characteristic colour, and could not be counted. For these reasons they are not included in the table. Moulds were found in only a very few samples.

Present factory methods of cream pasteurization at high temperatures yield cream which is almost sterile. Thus the various counts considered together may be assumed to reveal the extent of recontamination of the cream and butter subsequent to pasteurization, so that the results obtained should be a valuable indication of the sanitary condition of the factory plant. High figures provide definite evidence of the need for a "clean-up," even if the butter quality shows no signs of being adversely affected. A heavy infection of harmless germs may easily include one day a large number of types capable of doing serious damage.

From the figures given it is apparent that the bacteriological condition of a great many samples is satisfactory. Some 20 per cent., however, are not what they ought to be, on account of either excessive numbers, or bad types of organisms being present. In view of the fact that so much of the butter is turned out in satisfactory bacteriological condition, it should be possible for all butters to be of this standard.

As to the relation of these results to the grade of the butter, in the first place it should be emphasized that such tests are not intended to be used to grade the butter. In a few cases lower-grade butter was found to be of unsatisfactory bacteriological condition, and it was a fair assumption that the bacteria present were the major cause of the defective condition. But it is well known that besides bacteria a variety of other causes can be responsible for inferior quality. On the other hand, a number of cases occurred when finest butter was unsatisfactory in its bacterial content. This cannot be regarded as a desirable state of affairs, even if the butter suffers no apparent harm. The keeping-quality of such butter may be unsatisfactory. Bacteriological testing should serve a useful purpose in checking factory conditions and drawing attention to potential causes of trouble.

More samples are being examined during the present season, and these will be the subject of a further report. A more detailed account of the new methods together with the modifications and improvements developed by the laboratory will also be published later.

References.

(1) Barkworth, H., *Journ. S-E. Agr. Coll.*, 1933, 197.
(2) Johns, C. K.: *Scientific Agric. 8*, 1928, 353.
(3) Grimes, M.: *J. Dairy Sci., 17*, 1934, 11.

CARCASS-QUALITY IN BACON PIGS.

C. P. McMeekan, Massey Agricultural College, Palmerston North.

PART I.—NEW ZEALAND BACON PIGS IN RELATION TO UNITED KINGDOM MARKET REQUIREMENTS.

The export from New Zealand of frozen pig carcasses suitable for conversion into bacon is a comparatively recent development of the New Zealand pig-industry. Recognizing that types of pigs and feeding practices common in New Zealand are radically different from those in European countries supplying the United Kingdom market, the Manawatu-Oroua Pig Development and Recording Club designed the experiments detailed below to determine (*a*) the suitability for the United Kingdom market of the various types of bacon pigs in New Zealand, fattened on different dairy by-products, and (*b*) whether the supplementing of factory buttermilk with meals improves the quality of carcasses and/or the financial returns.

In designing the experiments the club wished to ascertain in particular whether the Tamworth, Berkshire, and Tamworth-Berkshire crosses of varying degree so peculiar to New Zealand and Australia produce carcasses markedly different from the white breeds of European countries, and whether the feeding of fattening pigs almost exclusively on dairy by-products is fundamentally sound in respect to both the financial returns and the quality of the product. The quantitative and economic results have been reported in another paper(9). The present communication is concerned only with the carcass-quality of the pigs. This is divided into two parts, the first being a study of the quality of carcasses produced from pigs of various breeds and crosses, reared and fattened on different farms, and the second dealing with the influence on carcass-quality of supplementing buttermilk fed to fattening pigs with concentrate meals at varying rates and over varying growth-stages.

Source of Pigs and Method of Examination.

Arrangements were made by the club's recording officer (Mr. W. J. Croucher, who also carried out the inspection and measurement of the pigs and the arranging of the trials) for a number of farmers to market selected lots of pigs representative of the average quality of New Zealand baconers, through one organization, which arranged for the slaughter, freezing, export, and disposal of the carcasses. In addition, pigs were available from feeding trials conducted at the farm of the Cheltenham Dairy Co., Ltd., and these were marketed through the same channel. Table 1 gives details of the number of pigs slaughtered and exported.

Table 1.—Source and Number of Pigs.

Source of Pigs.	Shipment Year.	Number of Carcasses examined.	Number of Carcasses exported.	Number of Farmers or Lots.	Number of Breeds or Crosses.
Farmers	1935	132	118	18	7
,, ...	1936	11	11	1	2
Experimental ..	1935	80	66	8	2
,, .	1936	40	36	5	2
Total ..	..	263	231	32	9

The pigs were slaughtered at the Kiwi Bacon Factory, Longburn, where as complete an examination as possible without cutting of the carcass was made. The carcasses were suitably identified, frozen, and shipped to London as the numbers accumulated. Here they were examined by the New Zealand Pig-carcass Evaluation Committee, established for the purpose, and composed of recognized authorities on carcass-quality(1). In each year the carcasses were examined at the same time. The order of reference under which the committee worked was as follows: "The general object of the consignments is to obtain critical and candid expert United Kingdom opinion upon all carcasses as to their suitability in respect of quality and weight for the United Kingdom bacon trade, the reports to indicate any specific weaknesses or defects to which the attention of the New Zealand producer might profitably be directed." The system of examination employed was very comprehensive and thorough, and was as described by Davidson, Hammond, Swain, and Wright(1). Complete data for each carcass on a basis of this method were supplied by the committee, together with individual photographs of loin-cuts. The committee also presented a statement covering the general conclusions reached.

It is convenient to note at this stage a slight variation in the method of examination in the evaluation of "proportion of fat" and "streak." In the 1935 shipment the former was measured at the "point of eye," while in the 1936 lots, at a point "1½ in. in from the middle line" on the loin-cut. The streak was evaluated by measurement on the loin-cut in 1935 and by eye assessment and standard photographs in 1936(1). Otherwise the methods used were identical for every carcass.

Summary of Evaluation Committee's Report.

The following extract from their reports summarizes the views of the committee:—

> "(*a*) *Conclusions.*—Viewing the shipments from a broad quality-angle, the following generalities may be made—
>
> "(1) The outstanding defect was a general deficiency in length, which is one of the most desirable characteristics in pigs destined for the Wiltshire bacon trade. Broadly, these pigs averaged 738 mm. for length of loin as against 800–850 mm. for Danish pigs of comparable weights.
>
> "(2) The consignments as a whole were good in relation to thickness of streak, eye of meat (indicating presence of ample lean meat), fineness of shoulders, and the hams were of good conformation.
>
> "(3) The thickness of back-fat was, on the whole, fairly good.
>
> "(4) It is emphasized that pigs below 126 lb. in weight are too light for the bacon trade.
>
> "(*b*) *General Policy.*—The present position would appear to be that baconer pigs now being exported from New Zealand are the surplus pigs of the porker trade fed on to bacon-weights. In other words, the present baconer pigs

appear to be porker-type pigs fed to bacon-weights and so are short in length in relation to weight. If the baconer pig from New Zealand is to be merely a by-product of the porker trade, we would advise marketing the present type of comparatively short pig at the lower bacon-weights—*i.e.*, at weights below the present English standard minimum of 140 lb. Otherwise there will be a marked and undesirable disproportion between length and fatness. If taken on to heavier bacon-weights the extra weight will be mostly fat and would result in a pig unsuitable for the bacon trade. It should be emphasized, however, that this type of low-weight baconer pig has a somewhat limited market which could be easily saturated. On the other hand, if New Zealand is going to make the baconer pig a primary product with a view to competing with the Continental type of pig it is vitally necessary that a different type of pig having greater length and maturing at a rather heavier weight should be bred. The development of this policy should not impinge on or adversely affect the present porker production, which has now attained a high standard and is of considerable importance in that it has few competitors compared with the baconer trade in the United Kingdom market at the present time.

"If it is thought desirable to introduce this new type of baconer it should be largely additional to the present pig trade and not as a substitute for it."

The above statement is illuminating in several directions as to the deserving of the serious consideration of producers, breeders, and others interested in the development of a profitable and extensive export bacon trade. The position calls for a more detailed presentation and examination of the data on which the observations have been based.

Carcass-quality Results.

Limitations of space preclude presentation of the detailed measurements and other data for the individual carcasses. The system of award of marks according to a definite scale on a measurement basis makes it possible, however, to obtain a reasonable picture of the average results, by expressing the actual marks received for the individual and total points as percentages of the possible awards in each case. This method overcomes the disadvantage of weight-disparities in making comparisons. It fails to allow for differences in the relative importance of the different points, however. The fact that eye of loin, length, proportion of fat, and streak together account for 80 per cent. of the possible marks in carcass-quality as a whole (hams, shoulders, and leg-length being of less importance) should be borne in mind in examining the figures. Comparisons between each farmer's lot and between the different breeds and crosses are set out for quality as a whole and for the individual characters in Table II (next page).

Table II.—Summary of Carcass-quality Results: Individual Farmers' Lots and "Breed or Cross" Groups.

Individual Breeders' Points.		Hams.	Shoulders.	Streak.	Eye of Loin.	Fat.	Length of Loin.	Length of Leg.	Total Breeders' Points.
Possible marks		8	7	12	28	20	20	5	100
Code Letter.	Average Weight.	Percentage of Possible Marks (Average).*							
Tamworth × Berkshire Cross (Number of Carcasses, 149).									
J. 2 ..	126 lb.	82	79	88	79	78	53	90	75
P. 18 ..	136 lb.	72	84	81	69	78	53	42	69
FT. 93 ..	137 lb.	77	75	92	57	78	27	66	63
H. 6 ..	127 lb.	65	84	89	61	80	33	30	63
L. 4 ..	119 lb.	66	71	88	43	74	54	70	62
E. 6 ..	137 lb.	86	86	89	57	47	46	67	61
F. 7 ..	128 lb.	91	71	89	52	54	31	89	59
G. 7 ..	142 lb.	61	86	53	63	65	35	51	58
S. 6 ..	144 lb.	80	76	79	37	26	15	93	44
Totals ..	136 lb.	75	78	85	58	70	35	62	62
Tamworth × Large White Cross (Number of Carcasses, 25).									
M. 8 ..	134 lb.	72	77	88	58	88	57	33	69
[illegible] ..	125 lb.	67	95	89	35	82	58	33	62
[illegible] ..	126 lb.	46	84	71	46	84	57	20	60
[illegible] ..	132 lb.	65	80	88	32	76	46	49	57
Totals ..	130 lb.	62	82	84	43	83	55	33	62
Tamworth × Large Black Cross (Number of Carcasses, 37).									
A. 4 ..	131 lb.	91	90	65	61	85	33	80	66
C2. 6 ..	145 lb.	95	88	66	63	87	30	60	66
N. 7 ..	143 lb.	65	84	79	80	63	22	46	62
FT. 20 ..	142 lb.	63	77	87	50	69	28	44	57
Totals ..	140 lb.	75	83	77	62	74	28	53	62
Large White × Berkshire Cross (Number of Carcasses, 15).									
R. 9 ..	145 lb.	79	70	75	54	82	47	62	63
C. 6 ..	144 lb.	98	100	69	36	87	18	60	57
Totals ..	145 lb.	86	82	72	47	83	35	61	60
Pure Breeds (T = Large White; D = Tamworth; Q = Large Black). (Number of Carcases, 18.)									
T. 6 ..	147 lb.	78	81	56	41	64	71	42	60
D. 5 ..	136 lb.	65	80	77	52	73	64	24	63
Q. 7 ..	135 lb.	68	71	77	56	87	43	29	63

* "Breeders' marks" only. See Reference(1).

The average value of the carcass-quality awards over all the pigs was approximately 60 per cent., a figure leaving much room for improvement. Individual farmer's lots varied from 44 per cent. to 75 per cent. in carcass-efficiency. The most common and serious cause of failure to reach high standards was shortness in length of loin. This was responsible for an average value of approximately 40 per cent., and, in the case of individual lots, for a variation of from 15 per cent. to 71 per cent. The figures bear out the contention of the committee and point to the necessity for immediate attention to remedy this defect. Eye of meat gives a disappointing value and a fairly variable value of from 32 per cent. to 80 per cent. It seems evident that the outstanding merit of New Zealand pork carcasses in this important character(2, 3) is not a characteristic of many pigs of bacon-weights.

The proportion of fat in the carcasses is more satisfactory, a reasonable average standard of approximately 75 per cent. of the optimum being obtained, despite the general tendency of short-type pigs "to show a marked disproportion between length and fatness." Had a greater number of the pigs been carried to heavier weights it is conceivable that the situation might not have been so favourable, but more in keeping with the committee's comments.

The relatively good values obtained for streak are surprising in view of the frequent adverse comment from trade interests upon this quality-point. This apparent contradiction results from the fact that while the thickness of the streak in proportion to the weight of the carcass was excellent, the actual thickness was insufficient, due to the low average weight of the pigs. This emphasizes one of the disadvantages to the trade of low-weight baconers. While the proportions of such carcasses may approach the ideal, the actual measurements of a particular area, such as the belly region, may render the latter almost valueless. On the basis of this argument and the actual results obtained it is evident that much of the trade criticism of the bellies of New Zealand baconers should be overcome by marketing within the higher bacon-weight range. Hams, shoulders, and legs attained a good standard over the pigs as a whole, though individual lots show a low value for legs in some cases, due to excessive length of leg.

Breed and Cross in relation to Carcass-quality.

The average figures for the different crosses and breeds were remarkably close, showing a range of only from 60 per cent. to 63 per cent. for carcass-quality as a whole. This supports the view previously expressed(4) that there is little difference between New Zealand breeds and crosses as to gross efficiency.

Between the various breeds and crosses characteristic differences are apparent, however, in respect to carcass-quality. These may be summed up as follows:—

(1) Tamworth-Berkshire crosses are very good in hams, shoulders, streak, and eye of loin, but are distinctly short.

(2) Tamworth - Large-White crosses are superior to all others in length of loin, are better than the first-mentioned cross in proportion of fat, but inferior to all crosses in eye of loin, length of leg, and hams.

(3) Tamworth - Large-Black crosses are the shortest of all breeds and crosses compared, and have excessive leg-length. Otherwise they are comparable with the Tamworth-Berkshire group.

(4) Large-White - Berkshire crosses are good in proportion of fat, but deficient in loin-length and eye of meat. They have not the leg weakness of the Tamworth - Large-White cross.

(5) Although the numbers of purebred animals are small, the average values attained are of interest. Large Whites have the greatest length, being better than any cross in this character. They have inferior eye of loin awards, and low leg-values. Tamworths give good length and fat values, but inferior legs and hams. Large Blacks are short of loin and excessively leggy.

It must be emphasized that these figures and comparisons, in view of the relatively small numbers of pigs involved, may not necessarily be representative of these breeds and crosses in New Zealand, and may rather be the picture of the average quality of different strains. With this limitation the data indicate that it is possible to obtain reasonably good-quality carcasses from any of the existing breeds and crosses, though one may be, on the average, superior to another in respect to individual quality characters (Plate 1, next page).

As distinct from these interbreed differences, wide variations in both carcass-quality as a whole and in individual quality-points are apparent within each breed and cross. This feature of the results is of particular significance since it points to the existence within a breed of pigs of different "strains" of varying carcass-efficiency. Though it is conceivable that the variations referred to may be due in part to management and feeding, this is unlikely in view of the nature of the differences.

The wide variation in carcass-efficiency of 30 per cent. within the Tamworth-Berkshire cross illustrates the point, differences in length of loin, length of leg, and proportion of fat, either singly or in combination, being responsible. Some farmers are seemingly provided with definitely superior classes of stock irrespective of breed. The position may be put another way: the differences within any one breed or cross, particularly in respect to length of loin, points to the existence of distinct "types," some of which are more suited to bacon-production than others.

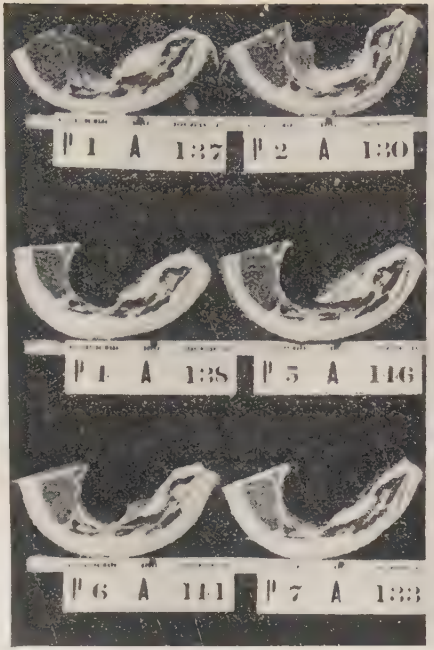
How far selection within these types will assist in the development of a higher standard in the national output is a matter of considerable moment. In this connection it is perhaps significant that within the Tamworth-Berkshire group—the most popular cross in New Zealand—no lot was capable of securing greater efficiency in length of loin than 54 per cent.

Weight in Relation to Carcass-quality.

The emphasis placed upon weight of carcass as a factor in quality by the committee has led to an examination of the data available with the object of determining the relationship more closely than illustrated by the general statement. The contention that New Zealand pigs are of a type which mature at lighter weights than the bacon-weights more in demand involves the concept that changes in the relative proportion

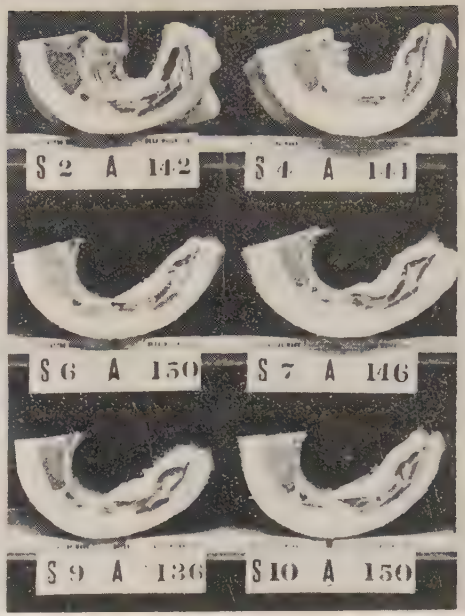
PLATE I.

Tamworth × Berkshire.



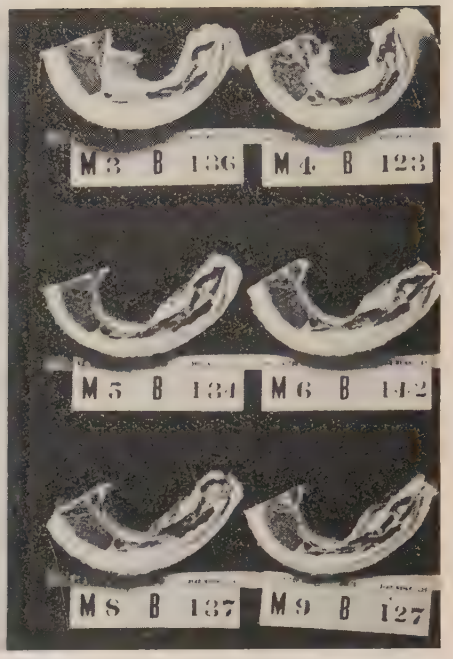
	Measurement. Mm.	Marks. Per Cent.
Eye of loin	49·0	73
Fat	23·5	78
Length of loin	740·0	43
Total breeders' points		70

Tamworth × Berkshire.



Measurement. Mm.	Marks. Per Cent.
37·5	36
36·3	30
725·0	15
	44

Large White × Tamworth.



Measurement. Mm.	Marks. Per Cent.
41·5	57
24·3	88
775·0	55
	69

of bone, flesh, and fat occur as the pig grows, and that the rate of development of such changes varies with the breed or "type" of pig. Bone develops first, flesh next, and fat last. Some breeds and types "mature," or have the desired proportions of bone, flesh, and fat, at lighter weights than others. This, on the one hand, makes some breeds and types more suited to pork-production and others to bacon-production, and, on the other, sets an optimum slaughter-weight for any given breed or type. An increase in weight above the optimum will be mostly fat and the resultant carcass less suited to market requirements(3, 5, 6).

Changes in length of loin, proportion of fat, and thickness of eye of loin, with changes in weight, have been investigated.

Table III.—Changes in "Length of Loin" with Increase in Weight.

Weight-range.	Number of Pigs.	Standard Length for Weight.	Actual Length for Weight.	Deficiency in Length.	Marks awarded.	Standard Increase with Weight.	Actual Increase with Weight.
lb.		Mm.	Mm.	Mm.	Per Cent.	Mm.	Mm.
115–119 ..	7	755	710	45	55	0	0
120–124 ..	12	765	716	49	50	10	6
125–129 ..	16	775	715	60	40	20	5
130–134 ..	46	785	726	59	40	30	16
135–139 ..	45	795	732	62	35	40	22
140–144 ..	41	805	730	75	25	50	20
145–149 ..	35	815	736	79	20	60	26
150–154 ..	19	825	733	92	10	70	23
155–160 ..	6	835	732	103	0	80	22

The relative length measurements at 5 lb. ranges from 115 lb. to 160 lb. are compared with the "standard" lengths for weight taken from the committee's published data(1). The deficiency in length relative to standard at each weight has been calculated, and the actual increase per 5 lb. increase in weight compared with the standard increase in length. Since the "standard" lengths for weight are based on the trade requirements for this character, and represent the ideal, the figures for the New Zealand carcasses measure the deficiency of the baconers at the various weights.

While length of loin has increased with increase in weight, the rate of increase has not been rapid enough, with the result that the deficiency below standard becomes progressively greater as weight of carcass increases. The effect is sufficient to penalize commercially the heavier carcasses.

The data indicate fairly conclusively that the length weakness in the present type of New Zealand bacon carcass, if this sample be taken as representative, will be less apparent at light bacon-weights, the pigs being of the relatively early maturing type in respect of length of loin—*i.e.*, comparable with pork-type pigs.

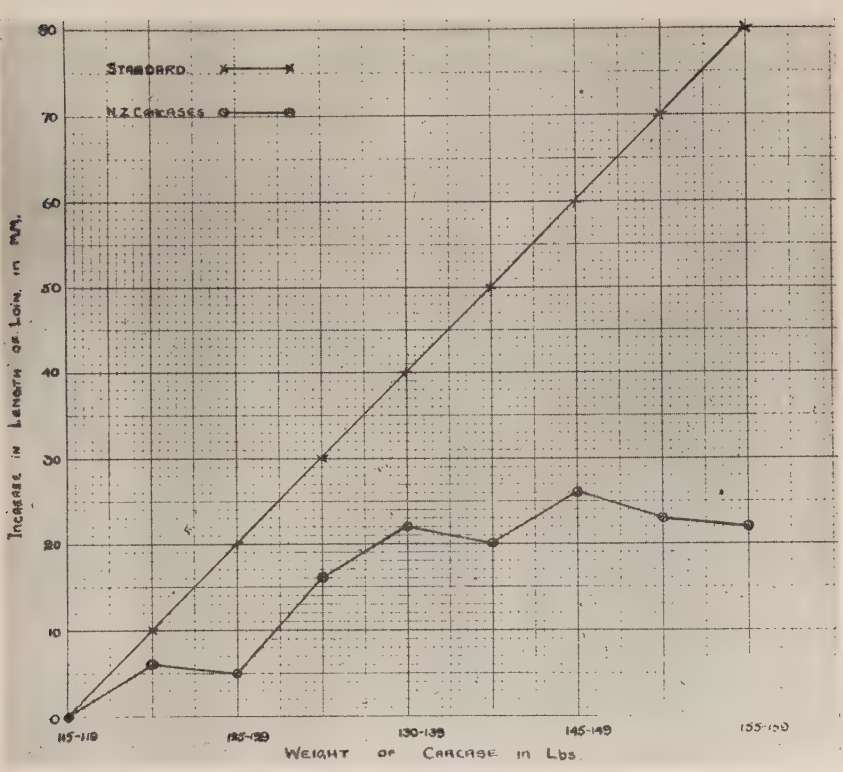


FIG. I.

Similar figures for proportion of fat and eye of loin are set out in Table IV.

Table IV.—Changes in "Fat at Point of Eye" and in "Thickness of Eye" with Increase in Weight.

Weight-range.*	Number of Pigs.	"Eye of Loin."		"Fat at Point of Eye."		
		Thickness.	Marks.	Thickness.	Marks.	Standard Thickness.
lb.		Mm.	Per Cent.	Mm.	Per Cent.	Mm.
115–119	7	38·0	70	22·0	98	21·75
120–124	12	40·0	75	24·4	92	22·25
125–129	16	42·0	85	24·7	90	22·75
130–134	44	41·0	80	25·4	92	23·25
135–139	41	40·0	75	26·5	88	23·75
140–144	30	41·0	80	28·1	85	24·25
145–149	21	43·0	85	28·2	85	24·75
150–154	8	43·0	85	29·4	82	25·25
155–160	3	39·0	65	32·0	60	25·75

* Cold-dressed carcass-weight.

Eye of loin shows but little variation within the weight-ranges studied, its thickness tending to increase but slightly with weight-increase. This would lend support to the contention that flesh is an early developing part in the pig-carcass, the proportion as indicated by the eye measurement having reached nearly maximum development at the lower bacon-weights in these carcasses. That the increase is sufficient to conform with the desired standard increase is indicated by the relatively uniform percentage marks awarded. It is not likely that weight of carcass within the bacon-weight range is a material factor in influencing the eye measurement.

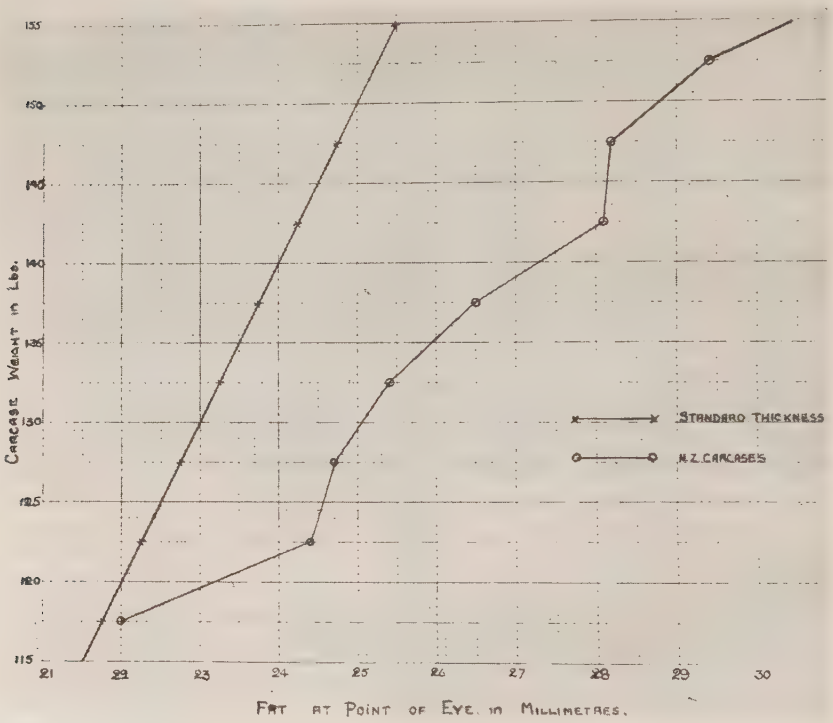


FIG. 2.

Proportion of fat, on the other hand, shows a similar undesirable tendency to length, an increase in the thickness at point of eye occurring with increase in weight, and the increase being greater than required if the "standard" thickness for weight be taken as a criterion. The position is clear from Fig. 2.

The pigs tend to approach the ideal in proportion of fat more closely at lower weights than higher, but it is important to note that the effect is not nearly as great as in the case of length and makes little material difference at weights up to 140 lb. and even up to 150 lb. This situation is significant in view of the fact that it is frequently necessary to market at least a proportion of bacon pigs at weights above 140 lb. in consequence of the seasonal nature of food-supplies in New Zealand.

Farm Feeds in Relation to Carcass-quality.

The experiments have shown that the practice of fattening pigs in New Zealand on a ration entirely or almost entirely composed of dairy by-products is capable of producing carcasses of good quality. No difference existed between the average results of pigs fattened on separated milk, buttermilk, or whey, though fairly wide variations in quality were apparent in the pigs fattened on any one type of by-product. These latter were probably due to type differences—*i.e.*, Plate I: Lots P and S of the same cross fattened on buttermilk alone. It is possible also that the excessive fatness recorded in some lots was due to excessive feeding during the latter stages of growth(7, 8).

Little precise information on the effect of small variations in feeding practice can be gathered from consideration of even large numbers of pigs uncontrolled for other factors productive of material effects upon quality. Specially designed feeding trials are essential for this class of work.

The Importance of Length of Loin.

A representative number of unselected bacon-sides from seven of the major supply countries in the United Kingdom bacon trade were measured in conformity with the method used throughout this investigation(1). The results show that New Zealand bacon pigs are shorter at all weights than those from competing countries.

Danish pigs have long been recognized as of outstanding length, but it is of interest to record the very excellent figures of Canadian products as coming on to the market at the present time. Canada has concentrated on improvement of this character during the last ten years by the adoption of special breeding and selection methods. The marked success which has attended her efforts in this direction suggests that her methods used merit serious attention by the New Zealand producer. The certificate-of-performance scheme for the improvement of pedigree pigs, instituted by the Manawatu-Oroua Pig Recording and Development Club in 1934, is based on the Canadian system, and offers to New Zealand pig-breeders a sound method of improvement of carcass-quality.

Commercial Grading Results.

In order to obtain an indication of the value of the pigs as assessed by commercial grading standards, all the carcasses studied in this investigation were graded also by the voluntary system in use at the export works concerned, and by the official grading standards in force in New Zealand in respect to bacon pigs used for both export and local consumption. In England the carcasses were also graded under the English official grading scheme at that time in operation. The results under the New Zealand and English official systems are reported in Table V.

Table V.—Commercial Grading Results.

Grading System	New Zealand.*		English Bacon.†			
Grade	First.	Second.	A.	B.	C.	D.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Under 140 lb.	62	38	..	..	..	..
Over 140 lb.	25	75	40	28	21	11
All carcasses	45	55	..	..	..	..

* Official Government standards. † Standards in force 1935–36 under British Pig Marketing Scheme.

At first sight the results under the English grading system are very pleasing, indicating as they do that even a larger proportion of the New Zealand carcasses reach the top two grades than many English pigs as indicated by published figures. The results are rather misleading, however, since the English standards do not involve length of middle in which New Zealand pigs notably fail. Again the fact that only 30 per cent. of the New Zealand pigs were able to be graded under the English scheme owing to the minimum weight-limit of 140 lb. reduces the value of the comparison.

The New Zealand grading results, which include "length standards," are probably more in keeping with the carcass value of the pigs. If "first grade" by this system be considered equivalent to grades A and B under the former system, it is clear that the length factor has been responsible for fewer pigs grading first in New Zealand. It is of interest also to record that the weight-length relationship previously noted is reflected in the commercial grading results when length is a factor, 65 per cent. of pigs below 140 lb. in weight grading first, as compared with only 25 per cent. on pigs over 140 lb. Increased proportion of fat in the heavier carassses also played a part in this respect.

Summary.

Considerable improvement is necessary in the present type of bacon pig exported from New Zealand if a high quality-status on the United Kingdom market is the objective of producers.

Shortness in length of loin is revealed as the most serious weakness. This is more apparent at high bacon-weights than at low, and points to the desirability from the quality viewpoint of marketing the present type of relatively short pig at weights below 140 lb.

Associated with this deficiency in length is a tendency toward overfatness. This is also correlated with carcass-weight and is penalizing to heavier carcasses, though the disadvantage of slaughter at weights above 140 lb. is not so acute as in the case of length.

Hams, shoulders, eye of loin (indicating proportion of lean meat), length of legs, and streak, attain a reasonably high standard on the average, though some types of pigs are defective in one or more of these characters.

There is little difference between the popular breeds and crosses in carcass-quality as a whole, though they may vary significantly in efficiency in respect to individual quality-points.

The Tamworth-Berkshire-cross pigs are too short in length of loin, while the Large White crosses are superior to others in this quality as well as in proportion of fat, though defective in other qualities. Differences within each breed and cross are very marked and point to the existence of suitable and unsuitable bacon strains. Selection within these on a carcass-quality basis is the logical line of attack in an improvement policy.

References.

(1) Davidson, Hammond, Swain, and Wright: *Pig Breeders' Annual*, 1936–37.
(2) Hammond: *Empire Jn. Exp. Agr.*, III, 9, 5; 1935.
(3) Callow: *Empire Jn. Exp. Agr.*, III, 9, 90; 1935.
(4) McMeekan: *N.Z. Jn. Agr.*, 52, 5, 278–289; 1936.
(5) Hammond: *Jn. Royal Agr. Soc. Eng.*, 93; 1932.
(6) ——— *Pig Breeders' Annual*, 28; 1933–34.
(7) Mansfield and Trehane: *Jn. Roy. Agr. Soc.*, 137; 1936.
(8) Fishwick: *Pig Breeders' Annual*, 115; 1936–37.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1936.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE certificate-of-record testing position at the close of the calendar year 1936 indicates a slight decrease in the number of first-class certificates issued as compared with 1935. A feature of the year was the increase in the number of cows tested in the yearly division, and the definite falling-off in the number of cows entered in the 305-day division. During 1936 first-class certificates of record were issued to 534 cows, as compared with 554 cows in 1935, 490 cows being in the yearly-test division and the remaining 44 in the 305-day division, the comparative figures for 1935 being 450 and 104 respectively.

(1) C.O.R. YEARLY TEST DIVISION.

The 490 certificates issued during the year represented an average production of 509·0 lb. butterfat, a decrease of 7·3 lb. over the 1935 average of 516·3 lb. fat for 450 certificates.

FIRST-CLASS CERTIFICATES ISSUED.

The number of cows which have been granted first-class certificates since the inception of the certificate-of-record system in 1912 now totals 9,867. Subdivided into breeds this total represents 7,297 Jerseys, 1,807 Friesians, 462 Milking Shorthorns, 222 Ayrshires, 69 Red Polls, 2 Guernseys, and 8 Shorthorns. Table 1 provides a numerical summary of yearly certificates of the first-class issued during the past two calendar years :—

Table 1.

Breed.	1936.			1935.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	383	35	418	352	28	381
Friesian	43	13	56	44	12	56
Milking Shorthorn	9	2	11	10	..	10
Ayrshire	3	1	4	1	..	1
Shorthorn ..	..	..	..	1	..	1
Red Poll	1	..	1	..	1	1
Totals ..	439	51	490	409	41	450

SECOND-CLASS CERTIFICATES ISSUED.

Thirty second-class certificates were issued during the year, 22 being gained by Jerseys, 6 by Friesians, 1 by a Milking Shorthorn, and 1 by a Red Poll. The previous year's total was 24. In the past year the average production of the 22 Jerseys was 512·55 lb. fat, the 6 Friesians averaged 600·16 lb., while the 1 Milking Shorthorn was credited with 646·28 lb., and the Red Poll with 547·44 lb. fat.

THIRD-CLASS CERTIFICATES.

Third-class certificates issued during the year numbered 47, comprising 42 Jerseys, 4 Friesians, and 1 Shorthorn. The average of the Jerseys was 496·48 lb. fat from 8,668·4 lb. milk in 364 days,

for the Friesians 707·04 lb. fat from 19,419·3 lb. milk in 365 days, while the Shorthorn gained a certificate for 411·61 lb. fat from 9,810·6 lb. milk in 365 days.

At the request of the New Zealand Dairy Breeds Federation it has been decided to withdraw all third-class certificates of record and to issue second-class certificates in their place. The issue of third-class certificates has been discontinued, and from the 1st January, 1937, there will be only two classes. The rules relating to the issue of first-class certificates will remain unchanged, while a second-class certificate will be issued to cows which comply with the rules for first-class certificate in all respects save period between calving for commencement of test and calving subsequent to test. Breeders concerned are being supplied with the necessary details.

Period between Calving.

The average period between calving for commencement of test and calving subsequent to test for the 490 cows granted first-class certificates in 1936 was 400 days, as compared with 404 days for the preceding year. The corresponding period for the second-class cows was 465, compared with 463 in 1935. The rules governing the testing allow a maximum period between calvings of 455 days for first-class certificate and 485 days for second-class C.O.R.

Jerseys.

Class Leaders.

None of the Jersey records completed during the period under review seriously challenged the existing class-leaderships for the breed. Credit for the highest Jersey for 1936 goes to Reshure Nova Supreme, owned by Mr. H. S. Fleming, of Clevedon. Commencing test at the age of 6 years 307 days, Reshure Nova Supreme gained a certificate for 945·00 lb. fat from 15,147·4 lb. milk in 365 days. This cow is also the holder of a third-class certificate for a production of 1,007·42 lb. fat on a record commenced at 4 years 78 days. The present Jersey class leaders are as follows:—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Beechlands Summer Lass	A. Moreland and Sons, Te Rapa	1 343	275·5	365	15,467·2	899·25
Senior Two-year-old. Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old. Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old. Woodlands Felicie	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature. Holly Oak's Annie..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

Jersey Class Averages.

Certificates issued to Jerseys in the yearly division in 1936 numbered 418, as compared with 381 in 1935. The 418 certificates represented an average production of 505·13 lb. fat, being 6·60 lb. below the previous year's average of 511·73. The averages class by class for 1936 and 1935 are given in Table 3 :—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1936.		lb.	lb.
Junior two-year-old ..	167	354	7,873·6	449·11
Senior two-year-old ..	40	345	7,862·1	452·47
Three-year-old	64	359	9,305·0	522·75
Four-year-old	54	354	10,084·2	575·91
Mature	93	354	10,283·4	575·12
	1935.			
Junior two-year-old ..	166	360	7,990·5	455·34
Senior two-year-old ..	40	357	8,988·7	499·60
Three-year-old	60	361	9,994·1	560·23
Four-year-old	42	356	9,900·5	564·92
Mature	73	358	10,435·2	576·13

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 are given in Table 4 :—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	3,280	349	7,267·1	409·31
Senior two-year-old ..	866	346	7,926·0	448·13
Three-year-old	1,217	346	8,705·9	487·25
Four-year-old	853	348	9,285·6	519·75
Mature	1,976	347	9,598·5	528·74
All	8,192	348	8,323·0	465·30

Average test, 5·59 per cent.

Jersey C.O.R. Bulls.

The names of 2,645 bulls are now included in the list of sires of C.O.R. Jersey cows, and of this number 542 have qualified for the C.O.R. bull class. A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. Forty bulls have now qualified for the Jersey Cattle Breeders' Association's champion butterfat bull class, the qualifications for this class being as follows : Each bull must have five or more daughters which under first-class C.O.R. conditions have

produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years of age, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. It is not necessary for each daughter to be from a different dam. The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., 560 lb., and 620 lb. butterfat respectively.

Friesians.

Class Leaders.

No changes took place in the Friesian class leaders during the year. The highest Friesian for 1936 was Moneville Sylvia Posch Mercena, owned by Mr. M. S. Rennie, of Mangere. This cow commenced test at the age of 5 years 36 days, and gained a first-class certificate for 838·77 lb. fat from 21,345·6 lb. milk in 345 days. This is the third certificate gained by Moneville Sylvia Posch Mercena, her record of 764·09 lb. fat in the senior two-year-old class being a particularly fine performance.

The Friesian class leaders are as follows:—

Table 5.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	3 247	336·7	365	25,885·3	989·10
Junior Four-year-old. Totara Veeman Lulu	Piri Land Co., Auckland	4 12	349·7	365	22,364·2	946·78
Senior Four-year-old. Totara C.R. Buttercup	Piri Land Co., Auckland	4 267	375·2	365	27,108·1	1,079·14
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

Fifty-six certificates in the yearly division were issued to Friesian cows in 1936, this being the same number as for 1935. Average production

FIG. 1. PUNGA NUI JOYCE (D. YANDLE, OWNER).

New class leader in junior two-year-old class, 305-day C.O.R. test division: 10,122 lb. milk, 590·91 lb. butterfat. *[Exporter photo.*

FIG. 2. MONEVILLE SYLVIA POSCH MERCENA (M. S. RENNIE, MANGERE, OWNER).

Highest C.O.R. Friesian, 1936: 21,345·6 lb. milk, 838·77 lb. butterfat in 345 days.

for 1936 worked out at 561·50 lb. fat, as compared with 563·95 lb. for the preceding twelve months. The Friesian class averages for 1936 and 1935 are as follows :—

Table 6.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1936.		lb.	lb.
Junior two-year-old ..	20	351	13,240·8	459·98
Senior two-year-old ..	5	359	14,510·3	499·81
Junior three-year-old ..	5	365	14,937·2	575·51
Senior three-year-old ..	3	333	15,237·3	562·21
Junior four-year-old ..	2	353	15,379·0	620·71
Senior four-year-old ..	6	330	16,553·9	561·04
Mature	15	361	18,784·3	704·88
	1935.			
Junior two-year-old ..	18	365	13,446·5	479·04
Senior two-year-old ..	5	365	13,927·4	516·54
Junior three-year-old ..	2	365	16,880·7	691·17
Senior three-year-old ..	7	321	15,773·9	550·08
Junior four-year-old ..	3	336	17,719·2	583·43
Senior four-year-old ..	5	334	16,429·7	587·15
Mature	16	350	17,281·1	653·57

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system in 1912 are given in the following table :—

Table 7.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	676	347	11,980·2	425·51
Senior two-year-old ..	276	349	12,849·5	457·85
Junior three-year-old ..	198	344	13,619·0	481·89
Senior three-year-old ..	201	337	14,183·6	509·34
Junior four-year-old ..	139	345	15,334·1	543·75
Senior four-year-old ..	142	346	16,229·5	568·36
Mature	613	343	16,241·3	574·00
All	2,245	345	14,069·3	498·87
Average test, 3·54 per cent.				

Friesian C.O.R. Bulls.

C.O.R. bulls in the Friesian breed now total 122, three new names having been added during the year. In last year's review the total was given as 120, but this should have read 119. Some 649 sires are represented in the 1,843 Friesian cows (including the 305-day division) certificated to the end of 1936.

Milking Shorthorns.

Class Leaders.

The Milking Shorthorn class leaders remain unaltered as the result of the past year's testing. The highest performance for the year for cows of this breed was put up by Bon Accord Nancy Lee, owned by Miss Rita Arnold, of Waimea West, Nelson. Commencing test at the age

FIG. 3. BON ACCORD NANCY LEE (MISS R. ARNOLD, WAIMEA WEST, OWNER).

Milking Shorthorn of highest production in 1936: 14,077·2 lb. milk, 670·62 lb. butterfat, as a junior three-year-old.

of 3 years 127 days the cow referred to is credited with 670·62 lb. fat from 14,077·2 lb. milk in 365 days. The Milking Shorthorn class leaders are as follows:—

Table 8.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th..	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Pinedale Beauty 4th	G. D. Hall and Son, Otorohanga	2 362	311·7	365	13,273·0	580·62
Junior Three-year-old.						
Matangi Quality 4th..	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th..	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Ashley Bank Winsome	Peach Bros., Sefton	4 298	378·3	365	17,687·7	730·93
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

Certificates were issued to eleven cows of this breed in 1936, as compared with ten in 1935. Their average production was 456·44 lb. fat from 10,880·7 lb. milk in an average milking-period of 360 days. Two of the cows were in the junior two-year-old class, three in the senior two-year-old, one in the junior three-year-old, and five in the mature class.

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 9.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	58	349	8,406·2	346·25
Senior two-year-old ..	46	350	9,020·3	376·83
Junior three-year-old ..	29	337	9,750·7	398·70
Senior three-year-old ..	32	344	10,999·8	457·26
Junior four-year-old ..	26	350	11,097·5	454·38
Senior four-year-old ..	34	343	11,623·3	462·59
Mature	285	342	11,817·6	473·46
All	510	344	10,958·8	443·31

Average test, 4·04 per cent.

Milking Shorthorn C.O.R. Bulls.

One new name was added to the Milking Shorthorn C.O.R. bull list during the year, the total now being sixteen. A total of 150 sires is represented in the 462 cows of this breed certificated to the end of 1936.

Ayrshires.

Class Leaders.

Four cows of the Ayrshire breed qualified for first-class certificate in 1936. The class-leadership list remains unchanged, being as follows :—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are given in the following table :—

Table 11.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	72	344	8,959·0	372·02
Three-year-old	40	347	10,028·0	413·26
Four-year-old	27	346	11,378·0	459·52
Mature	110	348	11,942·9	485·96
All	249	348	10,711·2	438·47
Average test, 4·09 per cent.				

Ayrshire C.O.R. Bulls.

One Ayrshire bull qualified for the C.O.R. class during the year, bringing the total to 13, while 126 sires are represented in the 225 Ayrshire cows (including the 305-day division) certificated to the close of 1936.

Red Polls.

Only one Red Poll cow qualified for first-class C.O.R. during the year, being in the mature class. This cow's record did not affect the list of class leaders, which is as follows :—

Table 12.

Name of Cow or Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old. Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old. Dominion Gold Top	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old. Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature. Waihou Pip ..	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows :—

Table 13.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	43	345	7,575·7	336·72
Three-year-old	16	346	7,905·1	349·63
Four-year-old	8	349	9,806·8	430·72
Mature	26	341	10,501·0	443·67
All	93	344	8,642·1	376·93
Average test, 4·36 per cent.				

Red Poll C.O.R. Bulls.

Twenty-eight different sires are represented in the sixty-nine cows of the breed (including one in the 305-day division) certificated to date. No new names were added to the Red Poll C.O.R. bull list during the year.

(2) C.O.R. 305-DAY TEST DIVISION.

Only 44 first-class 305-day certificates were issued during the year under review, 39 of these going to Jersey cows and 5 to Friesians. In addition, 2 Jerseys and 1 Friesian were granted second-class certificates in the 305-day division.

Jerseys.

Class Leaders.

The junior two-year-old was the only class which experienced a change of leader. In this class Mr. J. Murray's Erinview Moss, with 576·44 lb. fat, gives way to Mr. D. Yandle's Punga Nui Joyce, which raises the class-leadership record to 590·91 lb. fat. The class leaders are now as follows :—

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Punga Nui Joyce ..	D. Yandle, Te Wera ..	1 349	250·5	305	10,122·0	590·91
Senior Two-year-old.						
Erinview Joan ..	J. Murray, Woodville	2 339	284·4	305	10,130·1	607·08
Three-year-old.						
Glendale Silver ..	A. Montgomerie, Kawhata	3 319	318·9	305	11,352·7	631·42
Four-year-old.						
Hatcliffe Lady Gay ..	H. J. Kaye.. ..	4 60	329·5	305	10,619·9	664·49
Mature.						
Hua Brook Perfect Lady	H. Salway, Bell Block	6 5	360·0	305	12,837·1	676·13

Jersey Class Averages.

The production averages, according to age class, of the 39 first-class certificates issued to cows of the Jersey breed during 1936 are given in Table 15. The average for all the cows was 450·89 lb. fat, and the average test 5·76 per cent.

Table 15.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	18	292	7,184·0	412·27
Senior two-year-old ..	3	305	6,924·0	402·84
Three-year-old	6	302	8,071·6	474·14
Four-year-old	5	304	9,095·1	521·01
Mature	7	305	8,705·9	500·80

Friesians.

Class Leaders.

There was no change in the list of Friesian class leaders, which remains as follows :—

Table 16.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Sealands Magpie Pietertje 2nd	H. G. A. Cameron, Weraroa	2 22	252·7	305	11,727·4	454·16
Senior Two-year-old. Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·5	468·50
Junior Three-year-old. Totara De Kol Nina	Piri Land Co., Auckland	3 117	298·7	305	16,005·9	501·37
Senior Three-year-old. Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·8	389·04
Junior Four-year-old.	..	..	..	..	..	..
Senior Four-year-old. Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·9	557·71
Mature. Ellerlea Egie Segis Minto	C. H. Steadman, Pokapu	6 345	360·0	305	16,303·1	650·85

Friesian Class Averages.

The average production of the five Friesians which gained certificates during the year was 336·88 lb. fat from 8,698·8 lb. milk in 293 days. All were junior two-year-olds.

Thanks are again recorded to the various Breeders' Associations connected with the C.O.R. testing for their continued co-operation.

DIPPING MORTALITY ASSOCIATED WITH VIBRION SEPTIQUE INFECTION.

C. V. Dayus, District Superintendent, Department of Agriculture, Dunedin.

The provisions of the Stock Act require all long-wool or crossbred sheep to be dipped in the North Island between the first day of January and the last day of March, and in the South Island between the first day of January and the last day of April.

This enactment is provided as a means of exercising control in the infestation of sheep with external parasites, which tend to make sheep generally unthrifty, cause loss of blood from the animal, and damage the wool.

The common parasites in New Zealand are the "sheep tick" or "ked" (*Melophagus ovinus*) and three varieties of lice—the common biting louse, *Bovicola Ovis* (*Trichodectes sphaerocephalus*), the blue louse, *Linognathus ovillus*, and the leg louse, *Linognathus pedalis* (*Haematopinus pedalis*).

It is unfortunate, however, that a number of sheep are lost annually through carelessness in dipping, which is brought about in various ways. The majority of deaths occur through aspiration of the dipping-fluid into the lungs, thus setting up an acute broncho-pneumonia, or through a highly toxæmic condition due to infection with the organisms which produce blood-poisoning.

Other causes of mortality are chemical poisoning due to sheep actually swallowing the dipping-fluid, poisoning due to grazing contaminated pastures on which sheep have been turned without standing sufficient time to drain properly after dipping, death from exposure to adverse climatic conditions. If any extensive mortality from one or more of these causes is experienced, it is highly probable that there has been carelessness in the process of dipping, or in the management of the flock before and after dipping.

It is the purpose of this short note not to elaborate the reasons and means of prevention of all these causes of mortality, but to sound a note of warning in regard to one particular cause—viz., deaths due to infection with blood-poisoning organisms.

During the last few years it has been possible for me to inquire into several cases where a rather high mortality occurred in sheep after dipping from blood-poisoning due to the organism producing malignant œdema (*Vibrion septique*). In at least some of these cases infection took place from the dipping-bath itself, and it has been possible to recover the organism from the dipping-fluid, which was pathogenic for guinea-pigs. In fact, one sample of dip taken in April of last year still contains viable organisms pathogenic for guinea-pigs.

The common arsenical preparations made up into sheep-dipping fluids have little or no bacteriacidal action, and, consequently, it is easy to imagine how a dip which has become polluted by the passage of large numbers of sheep becomes a source of infection with an organism of which the soil is a natural habitat.

There comes a time when sheep put through this highly infected dip contract infection through skin abrasions due to recent crutching, dog-bites, rough metal in holding-yards, jagged timber and projecting

nails in pens or races, and feed "scald." All these causes of abrasions, in my personal knowledge, have at some time or other been the means of infection being introduced.

It is important then to clean out the dip thoroughly at the commencement of the season and again if necessary more than once during the season according to the capacity of the dip and the number of sheep put through. This process should include the complete emptying of the dip, the removal of all debris, and the disinfection of the empty bath, yards, &c., with some suitable and economical antiseptic solution such as Kerol or Jeyes fluid.

In malignant œdema infection there is usually an area of skin highly discoloured often in the region of the brisket or running up inside the thigh, which is doughy to the touch, pitting on pressure, due to the tissues at the point of invasion becoming infiltrated with yellow or red serum. The muscle tissue becomes an intense deep red, and is softened. Breathing is rapid, and the temperature is raised, and the sheep soon becomes moribund.

Deaths usually take place thirty-six hours to forty-eight hours after dipping, and may continue until approximately the end of the fourth day after dipping.

All animals dying from this cause should either be burnt or buried deeply, without skinning or opening, and the area dressed with burnt lime. The disposal of the carcasses is very important, as the organism sporulates in the soil, which increases the concentration of infection if carcasses are opened up and disposed of indiscriminately.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th February, 1937, to 25th February, 1937, include the following of agricultural interest:—

No. 74394: Flax-treatment; J. H. Nightingall, S. H. McBurney, and H. Hewitt. No. 74941: Cultivator-tine; F. S. Worsnop. No. 75638: Manure-distributor; O. W. Willis and J. T. Ryan. No. 75645: Emasculating implement; L. Daroux. No. 75779: Flax-treatment; R. H. Millburn and H. G. Milburn. No. 75944: Teat-cup; Ronaldson Bros. and Tippett Pty., Ltd. No. 76661: Milk-can; C. R. McLean. No. 77215: Manure-distributor; Bamfords Ltd. No. 75579: Milking-machine installation; A. B. Robertson and G. Allwood. No. 75680: Ensilage-grab; S. R. Pilkington. No. 76562: Determining sex of living organisms; C. R. A. Chadfield. No. 77171: Superphosphate treatment; The Davison Chemical Corp.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.

In this *Journal*, December, 1936, on page 323, appears the following statement: "Sutton's Sensation is merely an improved selection of Vilmorin's White-fleshed Purple Top (Hadfield and Calder, 1935)." Messrs. Sutton and Son's New Zealand agent draws attention to the fact that Sutton's Sensation Swede is a distinct variety bred by Messrs. Sutton and Sons, England, in 1928.

An order of the British Minister of Agriculture and Fisheries prohibits the landing in Great Britain of live poultry from any other country except Ireland, the Channel Islands, and the Isle of Man, except that consignments may be landed with a special license previously obtained and subject to special conditions regarding quarantine and disease-control. The order also makes similar provision regarding day-old chicks and eggs of domestic fowls declared to be intended for hatching.

LUCERNE IN THE WELLINGTON, TARANAKI, AND EAST COAST DISTRICTS.

C. J. HAMBLYN, Fields Superintendent, Department of Agriculture, Palmerston North.

IN two papers read by officers of the Department of Agriculture at the 1936 conference of the New Zealand Grassland Association, the growing of lucerne as a forage crop in districts of relatively high rainfall was dealt with. The area covered by the papers included the Manawatu and west coast from Paraparaumu to the Patea River(1) and Taranaki(2). During the subsequent discussion on these and other papers the present position and general trend in regard to lucerne-growing in the Wairarapa, Hawke's Bay, and Poverty Bay districts were also touched on. It is the intention here to review briefly some of the more important points in regard to the cultivation of lucerne in the southern portion of the North Island as discussed at the conference.

In general, while none of the area can claim to have climatic and soil conditions comparable with those of the great lucerne-growing countries of the world, there are in many of these districts conditions under which lucerne thrives and where the crop is of considerable value in providing an abundance of green, nutritious food during dry summers, and excellent material for hay for use in the winter months. Evidence was forthcoming to show that lucerne has during the past twenty to thirty years been tried out under practically all kinds of conditions of soil and climate in this portion of the Island, and that there has been a sorting of the localities in which lucerne can be established and maintained successfully, and where the crop fills a definite need in the farm.

Two outstanding features appear to be common to those areas where lucerne can be said to be an important feature of the farms, first, a freely draining subsoil, and second, dry summers, if not annually, then at least once in a while and frequently enough at any rate to bring out the value of lucerne as a green forage crop as compared with the pastures with which it has to compete for its place on the farm. Another feature which is common to lucerne-stands throughout the area under review, and which is a limiting factor in the life of the stands, is the favourable conditions during the autumn, winter, and spring for the growth of weeds and grasses which can seldom be dealt with at this period of the year by cultivation, owing to the moist soil conditions.

The general trend throughout the area is for lucerne to be concentrated in those localities where favourable conditions of soil and climate, as described already, occur together. Because sheep are less dependent on green fodder in dry summers than are the dairy cows, the largest area in the aggregate is to be found on the dairy-farms, though the stands are individually smaller than is the case on sheep-farms. There has been a definite and continued increase in the acreage of lucerne throughout the southern provinces, and there is still scope for extension. The problems in connection with the further utilization of lucerne can best be discussed by reviewing the position district by district.

Taranaki(1).—Of a total of some 4,800 acres in lucerne in Taranaki, practically the whole of the really successful stands are confined to the southern counties of Waimate West, Hawera, Eltham, and Patea, an area of comparatively low summer rainfall and occasional drought conditions. Here, however, the stands are comparatively short-lived owing to winter weed-invasion, and special attention to weeds in establishment and the use of autumn-sown oats or barley to smother winter weed and grass growth are considered essential to satisfactory lucerne stands. A falling-off of the area in lucerne during recent years in South Taranaki may be accounted for by the invasion by weeds and grass of the older stands and by the difficulty in utilizing the crops during comparatively wet summers. In North Taranaki the soils of the dairying belt are generally suitable to lucerne, but the good summer rainfall experienced is not favourable to the satisfactory maintenance and utilization of lucerne.

Wellington(2).—The area in lucerne has more than doubled during the past five years. The position in the Manawatu and west-coast area of comparatively high rainfall, with, however, sufficiently dry summers, particularly along the coastal belt, to bring out the advantages of lucerne as a summer-feed producer, was dealt with in the conference papers(2). The best and most easily maintained lucerne stands are to be found on the freely draining sandy loams of the coastal belt, extending from Patea to Wanganui and beyond, with good stands also on the silts of the river-flats. A considerable extension of lucerne areas is possible on the more recently consolidated coastal sand-dune country which extends from Paraparaumu in the south up to Wanganui and Patea. This belt, which is but recently being developed, extends for several miles inland, and lucerne is destined to play an important part, as the summer-feed supply is a difficult problem owing to the rapid drying-out of the sandy soils. Lucerne can be successfully established and maintained, though the yield is not so high as is the case on the older consolidated sands farther inland. Green summer feed is invaluable, however, and lucerne has proved its ability to fill the need for it.

The extension of lucerne-growing on the richer, free-draining silts of the extensive river-flats throughout the Manawatu and Rangitikei districts is a matter well worthy of the consideration of farmers on these lands. The ease with which lucerne grows, the heavy yield of high feeding-value, and the certainty of good summer production irrespective of dry spells are points strongly in its favour. In the Wairarapa during the past five years a very marked increase in the area in lucerne, especially in the southern districts, has been recorded. There is still a considerable scope for lucerne on the extensive areas of free-draining shingly and silty soils subject to severe drying-out in the summer. In many districts where the subsoil is stiffer and lucerne does not last as a paying crop for more than five to six years, its value in dry seasons still is such as to warrant the establishment of a stand. A profitable stand under these conditions is one that produces three to four fair cuts a year for from four to six years. In the northern bush districts, with a higher rainfall, but suitable lucerne soils, occasional dry summers demonstrate the desirability of some lucerne on the smaller dairy-farms, and, in spite of difficulties with winter weeds and grass-invasion, the area in this crop is being extended.

Hawke's Bay District.—Of some 5,000-odd acres of lucerne in the Hawke's Bay District, by far the greater proportion is grown on the richer loamy silt soils of the Heretaunga Plains, where the stands are exceptionally prolific and remain productive for a long period. In more recent years the successful growing of lucerne by farmers in many other parts of central Hawke's Bay, and more particularly on the Takapau Plains and the lighter soils of the Tikokino and Norsewood districts, has been followed by a marked increase in the area in lucerne in these localities. A large proportion of the soils of Hawke's Bay are suited to lucerne, and though the invasion of stands by weeds and grass is a serious problem in the areas of higher rainfall, the summers are generally such that the value of lucerne is sufficient to warrant the establishment of stands on a much larger number of farms than it is on at present.

Poverty Bay.—In this district very favourable conditions are found for lucerne on the silts of the extensive river-flats round Wairoa, Gisborne, and the various rivers up and down the coast. A considerable portion of this country is devoted to dairy-farming, and it is on the dairy-farms that lucerne stands are found most useful, particularly in dry seasons. The area in lucerne in Poverty Bay has shown a steady increase in recent years, and there is scope for a much greater use of this crop, particularly on the lighter soils of the district.

Summary.

Of a total of some 40,000 acres in lucerne in New Zealand, about 15,000 acres are grown in the area dealt with in this review. A steady extension of the lucerne area during the past fifteen years to twenty years, with a more rapid yearly increase in the past five years, is recorded. Good lucerne-growing areas are those with deep free-draining soils, the productivity of the stands varying with the natural fertility, and the satisfactory utilization of the crops and therefore the need for lucerne varying with the severity or otherwise of the dry conditions experienced on the average in the summer. The drier the summers the more need for lucerne and the better the conditions for harvest and utilization.

The useful life of stands is dependent on subsoil conditions, and, in this area, also on the possibilities of weed-control according to the amount and distribution of the rainfall.

Though the value of lucerne in the main recognized lucerne-growing belts has been taken advantage of to a fairly satisfactory extent, much more land could probably be devoted to lucerne with advantage on dairy-farms in suitable localities where the summers are particularly dry. Further, on extensive areas such as the Manawatu and west-coast sand-dune country, the Wairarapa Plains, Takapau Plains, and elsewhere, lucerne, because of its special value under dry-summer conditions could with profit be much more extensively used. Finally, experience has shown that lucerne is not really profitable on those extensive areas of country with stiff subsoils and generally high and fairly evenly distributed rainfall.

References.

(1) Elliott, A. G.: Paper read at 1936 Conference of the New Zealand Grassland Association.

(2) Lonsdale, T. W.: Paper read at 1936 Conference of the New Zealand Grassland Association.

LIMONITE FOR STOCK-LICK PURPOSES.

Chemistry Section, Department of Agriculture, Wellington.

SAMPLES of limonite rock from the Okaihau quarries recently tested have been found to be very variable in cobalt content. Among the deposits being worked are some that contain over 250 parts per million of cobalt. To secure reasonable uniformity the company working the deposits is now selecting the rock so as to result in a product of anticipated cobalt content of 200 parts per million. A sample of such ground material ready for distribution gave a figure of 210 parts per million.

The Department of Agriculture has arranged for systematic supervision of the commercial samples of limonite offered for sale to ensure that the specified content of cobalt is satisfactorily maintained.

Recent experiments indicate that cobalt is the element present in limonites which is chiefly responsible for their beneficial effect when used as stock lick in bush-sick country.

Ruatangata limonite which has given such good results usually contains from 50 to 100 parts per million of cobalt, but it is quite probable that deposits of higher cobalt content may exist in this locality.

There are some indications that nickel, zinc, and perhaps other trace elements may exert a beneficial effect in addition to that of cobalt, so that it is impossible at present to evaluate a limonite for stock-lick purposes solely on its cobalt content. The determination of some of these trace elements in a variety of limonites is in progress, and the results will be reported later.

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers whose wheat crops have passed both the field and the grain inspections required under the Government scheme for the certification of seed-wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably tagged and sealed.

Variety.	Grower.	Acreage.
Cross 7	Allan, R. G., Windsor	10
	Blackwater Est., care of H. Neave, Leeston	17
	Foster, J. A., Springston R.D.	14
	King, L. R., Waipara	11
	Mills, Mrs. A. J., Grovetown, Blenheim ..	11
	Sowden, F. G., Aylesbury	40
	Stewart Bros., Templeton	10
	Tutton, F. A., Springston R.D. ..	9
	Whyte, J. S., Pakakaio	22
Dreadnought ..	Brookes, J., Brookside	9
Hunters II ..	Rennie, W. O., Doyleston	13
Jumbuck ..	Bailey, P. V., Springston R.D. ..	20
	Rennie, W. O., Doyleston	4
Solid Straw Tuscan	Lambie, R. T., Leeston	20
	McLaughlin, D. W. S., Dunsandel ..	8
	Tutton, F. A., Springston R.D. ..	11

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Autumn Management of Grassland.

BECAUSE exceptionally bountiful rains have been very widespread this summer, coarse mature woody herbage has been carried over much more extensively than usual from the summer period of heavy production. As a rule such coarse growth should be removed in the autumn: it delays the development of the fresh leafy condition which in the autumn characterizes pastures that have been well grazed throughout the year. If it is not practicable to employ store stock in the removal of the tall coarse growth, then it is likely to be advisable to remove it by "topping" with the mower. Apart altogether from the tall coarse growth of the pastures species, topping of pastures may be valuable to remove the aerial portions of shade-creating weeds such as docks, spear thistles, and willow-weed. If weeds of this type are not removed they tend to weaken greatly the pasture-plants in their immediate vicinity and to create vacant patches on which inferior plants later become established. When they are mown, however, they cease to create the shade which is harmful to valuable pasture-plants.

Autumn harrowing of pastures is a valuable practice which widely may be carried out advantageously in March on dairy-farms. A main benefit of such harrowing is the distribution of animal droppings which, when suitably scattered, are of considerable fertilizing value, but which, if not scattered, tend to bring about deterioration instead of improvement of the pastures and to increase the difficulty of carrying out fully efficient grazing. The thorough distribution of droppings that is desirable usually necessitates two harrowings; one harrowing at right angles to the other is more serviceable than two harrowings in the same direction around the field.

Top-dressing.

Many could profitably spend more on top-dressing of grassland than they are spending. Grassland of low productivity may often be made of high carrying-capacity by adequate use of fertilizers, provided the management is made appropriate to the changed character of the sward. In such cases the main questions the farmer has to decide relate primarily to additional stocking.

Firstly, before launching out on an increased top-dressing programme the farmer must be assured either that he can finance the purchase of the additional stock needed to cope advantageously with the increased production of feed or that he can otherwise dispose profitably of the feed by hay-making, by selling, grazing, &c. The crux of the position is that understocking may result not only in waste, but also in pasture-deterioration and in other undesirable effects. This has been well exemplified in the current producing season when the increased production of feed that has brought about understocking has been due not to top-dressing, but to the unusual abundance of moisture.

Possibly there has been too much tendency to consider top-dressing as a means to increased production: top-dressing certainly has caused much of the increase in our farm production during recent times; but on thousands of farms it now is the essential measure in avoiding decreased production. Hence a farmer who does not seek to increase his production may, nevertheless, need to top-dress more freely than he plans. The residual influence of previous top-dressing is particularly likely to mislead

farmers to the unfortunate conclusion that their grassland is not being affected detrimentally by discontinuance of top-dressing. Instances have come under notice where farmers who have regularly been applying liberal dressings of superphosphate or other phosphates have discontinued top-dressing for a season; and for that season the carrying-capacity has not always been affected appreciably. But the immediate effect on the carrying-capacity is not likely to indicate the ultimate effect of not top-dressing grassland the productivity of which has been built up even partially by earlier top-dressing. This earlier top-dressing normally, under New Zealand practice in which phosphates dominate, creates reserves of fertility which represent part of the current capital value of the farm and management which does not provide for the maintenance of these reserves, simply involves living not upon income wholly but upon capital to some extent at least.

The opinion has been voiced in public authoritatively that about half our total production of butterfat may be attributed to an annual outlay of about £2,000,000 on fertilizers for top-dressing. As the value of the butterfat now produced annually approximates £20,000,000 (with butterfat at 1s. a lb.) it is clear that the dairying of the Dominion is receiving a handsome gross return for its outlay on top-dressing—a gross return which assuredly leaves an attractive net profit.

When only a portion of a farm is to be top-dressed it is, as a rule, advisable to select two types of fields for treatment. In the first place a special endeavour should be made to top-dress newly established pastures: it is likely to be more profitable in the long run to prevent, by suitable top-dressing, early deterioration of young permanent pastures than later on to renew or repair them when deteriorated. Secondly, and apart from young pastures, when only a portion of a farm is to be treated it is advisable as a rule to top-dress the fields supporting the better swards; then the effect of the fertilizer is exerted on a greater proportion of the better pasture-plants, which have a greater capacity of responding usefully to improved fertility than have the inferior plants or weeds which are more common in the poorer swards. For instance, more is accomplished by stimulating the growth of rye-grass or of cocksfoot than by stimulating that of brown-top or of rib-grass.

Despite the fact that there is widespread scope for profitable extension of the area top-dressed, it needs to be kept in mind that top-dressing is not always and necessarily economic. In short there are grassland areas on which top-dressing cannot be recommended. This is true chiefly of land of relatively low carrying-capacity, and especially is this so when low prices prevail for the produce of that land. The converse of this is provided in the fact that the recently improved prices of wool and sheep has made top-dressing profitable on sheep-country where previously it was unprofitable. The position probably may be summed up in a manner useful for practical guidance by saying that the area on which top-dressing is not profitable at ruling market prices and on which "wet" stock are carried are exceptional, and a farmer should be sure his is one of these exceptional areas before he eliminates the assistance of suitable top-dressing from his farming.

Further, the potentialities of profit from top-dressing can be realized properly only when the top-dressing is judicious and available evidence points to the conclusion that at times top-dressing is far from judicious. Injudicious top-dressing arises in two main ways: sometimes funds are dissipated on top-dressing material from which little or no visible benefit has been noted, whereas often the funds could have been devoted to the purchase of other material which is known to give eminently economic results; sometimes the potential benefit from one fertilizing-material which is used is wholly or partially lost unless another material is used also, and in practice this second material is omitted. In liming the two

phases of injudicious top-dressing are exemplified; sometimes lime is applied when there is no evidence that it is profitable to use lime, and sometimes lime is not used when phosphate is used and when that phosphate gives a poorer return than it would give in association with lime. The position in regard to potassic fertilizers is roughly similar to that in regard to lime.

For some years a survey of the response of grassland to these fertilizers has been progress and information regarding the response in specific areas is obtainable from local officers of the Fields Division.

In general, the first objective in top-dressing should be to increase the supply in the soil of phosphate available to the crop. The results in the field well justify the very general use of superphosphate, relative to which there are two facts which still seem not to be generally known: superphosphate does not cause any permanent increase in soil-acidity, and superphosphate is far from fleeting in its influence.

Over wide areas of fairly heavy rainfall basic slag is known to give uniformly good results, and in districts of good rainfall African and similar phosphates may be expected to prove satisfactory. Because of the variable visible results from district to district of both lime and potash it is really futile to make any general statements regarding them: the best course for those desiring guidance about them is to seek information from local officers of the Fields Division.

Wheat-growing.

In the main South Island wheat-growing districts spring-sowing should be carried out only when circumstances necessitate it—autumn and early winter are the ideal sowing-times. In the most southerly wheat areas and in the North Island spring is usually the most advisable sowing-season. Hunter's, Pearl, and Velvet definitely should be sown in the autumn or early winter. Solid-straw Tuscan may be sown both in the spring and in the autumn or early winter.

Wheat needs a fine but firm seed-bed. The advisability of firmness often makes it possible to grow wheat successfully without ploughing after peas or potatoes, the sowing of the wheat being preceded simply by two or three diskings. It is not desirable to work the surface soil down to a very fine condition, for fine particles have a tendency to "cake" at the surface, whereas small lumps break down gradually into a desirable fine loose surface, and in their early stages provide some shelter for the seedlings. When wheat is to follow grass or clover, skim-ploughing should have been done before these notes are published, and, if not, it should be treated as urgent work. About six weeks after the skim-ploughing, the surface should be disked to obtain a fine condition, and then ploughing to a depth of 6 in. should be carried out. When wheat is to follow oats or wheat the stubble should be first disked or grubbed, and, to obtain a fine tilth, should later be ploughed to a depth of about 6 in. When wheat follows grass or a cereal crop there is always danger of infestation by the grass-grub.

Extensive trials carried out over a series of years have shown that over a wide range of country quite a good profit results from the use with wheat of 1 cwt. of superphosphate to the acre, and the bulk of the wheat sown for some years with satisfactory results has been manured accordingly.

Measures of distinct value in controlling certain serious diseases of wheat should be made a routine feature of our wheat-growing. Further, these measures should be carried out properly, for, if they are not so carried out, they are likely to be ineffective, or, alternatively, at times to cause injury to the seed. The present trend in the treatment of seed-wheat is to replace wet pickles, usually solutions of blue-stone or formalin, by various substances used as dusts. Advantages of dusts are the absence of danger of injury to the seeds and the convenience due to the fact that dusted seeds keep well without damage, so that dusting may be carried out at any

convenient time instead of being restricted to the busy time of sowing. Full information about the effective dusting of the seed of wheat and of other cereal crops is obtainable from officers of the Fields Division. The treatments of seed of oats and barley is just as advisable as is that of seed-wheat, unless it is quite definite that the crop is being grown only for green feed.

General Work with Crops.

Oats for winter and spring feed and subsequent grain-production should be sown not later than April or early May. Generally they respond profitably to the use of 1 cwt. to 2 cwt. an acre of phosphatic manure in which superphosphate is the dominant ingredient. The proved kinds of Gartons may be looked upon as the best all-round oats for the South Island. Gartons does not stand feeding-off to the same extent as Algerians, and should be fed-off once only and that feeding-off should be done quickly. Algerians, which are best when autumn-sown, are much used, with success, for green feed: they can be fed-off both in autumn and spring, and provide good chaff.

Quite often maize and millet grown for green feed suffer damage from autumn frosts. To avoid such damage these crops should be utilized during April, and preferably in the first half of the month. When abundance of other feed makes unnecessary the feeding to stock of these crops in a green condition, as is likely to be the position often this year, then they should be conserved preferably as silage.

Swedes which have suffered a serious attack of dry-rot should be fed off without unnecessary delay if they can be utilized to advantage.

Sometimes after the last cut of the season lucerne is grazed, and, in consequence of the trampling of the stock, the land is consolidated. The consolidation favours the invasion of the lucerne by weeds, including grass and clover. When it is desired to maintain the stand of lucerne as pure as possible, then late-season grazing of it is clearly inadvisable: it is especially so in districts of good rainfall in which weed-invasion is one of the worst troubles in lucerne-growing.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spraying.

GROWERS are advised not to discontinue the application of arsenate of lead at too early a date. Codling-moth and leaf-roller caterpillar are usually still active, and it is therefore advisable to continue with the arsenical application until a few weeks prior to picking.

As the danger from black-spot infection is not yet passed, it is advisable to continue with fungicidal sprays for a while longer on susceptible late varieties of apples and pears. Where brown-rot fungus has been troublesome a careful examination should be made, and all mummified fruits removed from the trees and ground and destroyed by burning. In addition to this, an application of Bordeaux 5–4–50 is recommended, and should be made as soon as possible after the fruit has been picked, to assist in controlling the disease.

Orchardists should investigate thoroughly the results obtained during the season from the spraying-compounds used and the methods employed in preparation and application. When unsatisfactory results are obtained something is wrong. Factors which contribute to success are the thorough application of sprays at the correct times, use of the correct compounds, proper mixing of sprays, and an elementary knowledge of the life-history of pests and diseases.

Harvesting and Storage of Fruit.

During the coming weeks harvesting and storing of fruit will be engaging most of the orchardist's attention. Every endeavour should be made to pick the fruit as soon as it is ready. It is again necessary to emphasize the necessity for the careful handling of the fruit, as the percentage of damaged fruit arriving on the markets is much higher than it should be.

The result of careless handling is frequently not felt so severely during the earlier part of the season, when the fruit is sold immediately after it is picked, as it is with the later varieties, which are usually held for a time.

Fruit intended for storage should be most carefully handled and graded, and all bruised fruit or fruit with a broken skin and with other blemishes detrimental to the quality and appearance of the fruit should be rejected for cold storage. The graded fruit should be placed in the cold store as soon as possible after picking. A little trouble in the way of placing the various sizes and grades of fruit in the store so that they may be readily got at will save much inconvenience and additional handling when the time arrives for marketing the fruit. It is the practice of some growers to wrap the fruit when it is being packed for storage for the local market, which is quite good practice, except that it entails extra work if the fruit requires to be sorted before being placed on the market.

Fruit-export Work.

Despite the wet and cold season experienced throughout New Zealand, reports from several districts indicate that both apples and pears are maturing earlier this season, consequently, where this condition is observed, picking-dates should be advanced accordingly. It should be borne in mind that overmature fruit, if exported, cannot be expected to arrive at its destination in a satisfactory condition. Fruit that has passed the suitable stage of maturity for export, even though it may be packed some time prior to closing-date for the variety concerned, is certain to be rejected at the inspection. Any line of fruit that has reached the border-line between mature and overmature for shipment overseas should have the larger sizes withdrawn, and only the smaller sizes submitted for examination. Many varieties of fruit picked before the correct stage of maturity has been reached are inclined to wilt during transit, and fail to develop the true and full flavour of the variety. While the condition is to be carefully guarded against to maintain the good reputation of New Zealand fruit on the overseas markets, it is possible that even greater damage to the reputation of our fruit and lower market realizations would result from the export of overmature fruit.

—B. G. Goodwin, Orchard Instructor, Christchurch.

Citrus Culture.

Disease-control.—The season for spraying is not yet over. Temperatures will still be sufficiently high for the germination of the spores of verrucosis, and those who know the disease to be present in their orchards should apply Bordeaux 3–4–50 to their lemons, timing the application so that it is made when a fair proportion of the autumn blossom is just over full bloom. As the fruit is known to become infected only when it is small, it will not be advisable to delay the application for verrucosis-control until a month later, which time would most likely be more appropriate for a cover spray for protection from brown rot. The fruit forming at present will be harvested in the summer-time, and although it is generally the lighter of the two main crops it is more valuable for that reason. In the past a number of growers who have kept the main spring setting clean have overlooked

the matter of protecting their autumn set of fruit, with the result that verrucosis has been prevalent and they have been unable to enjoy the benefit of the higher prices. It will be necessary to apply Bordeaux 3–4–50 to oranges and New Zealand grapefruit before the winter sets in. Where leaf-roller caterpillar is present, arsenate of lead powder, 1½ lb. to 100 gallons, should be added to this spray. Instances have come under notice of the foliage of newly planted New Zealand grapefruit trees becoming infected with verrucosis, so that young trees should receive attention where necessary.

The scale insects, particularly the red scale, and in some localities the various species of wax scales, will still need to be considered according to the prevalence of the pests and the specifics which already have been applied. Those who have decided that two applications of summer oil 1–33 are necessary should get the second one on during the period March–April, and those who have aimed at applying only one oil spray should also have the work completed by this time. Not only experiments carried out by the Government but also growers themselves have demonstrated that red scale can be eradicated provided that the job is done thoroughly. This needs three things—viz., an efficient high-pressure spraying plant; reliable, energetic, and determined operators; and the trees in such a condition that they can be sprayed properly. It is very pleasing to note that a considerable number of citrus growers have brought their spraying-apparatus up to date during the past twelve months, most of them having installed the piping-system with stationary pump and electric motor. Those who have not done so should seriously consider the matter, as competition in production is now so keen that only the efficient and up-to-date grower can hope to succeed. The cost of installing a spraying-outfit complete with shed, tank, motor, hose, piping, &c., may be worked out approximately as follows: £20 per acre for the first five acres, £10 for each additional acre. Costs are rising, so that those whose plants are inadequate should endeavour to finance new installations without further delay.

Pruning.—While the picking is light growers may find it convenient to pay more attention to pruning. Experiments carried out in America appear to prove that pruning, in the form of a methodical thinning-out of the tree as practised with deciduous fruits, reduces the yield and does not improve the grade or quality of the fruit. In spite of this, however, there appears to be a certain amount of work to be done, not as straight-out pruning, but more in the form of a touch-up here and there during picking operations. In addition to cutting back weak and spent wood to healthy foliage, some attention should be given to shortening of long spindly leaders and laterals. This will tend to obviate bad breaks, and, just as important, will lessen the amount of blemished fruit produced. The present need is for better citrus fruits, and while factors beyond the control of the grower, the weather for instance, cause some of the "rejects," there is still much that can be done to improve the grade of the fruit The year of heavy crops is naturally the best time to practise pruning by way of thinning, because during that year the grower will not miss the fruit taken off, while in a light-crop year he wishes to harvest all he possibly can. It is generally agreed that the poor keeping-quality of lemons at certain times of the year is due partly to the fact that they have taken too long to come up to size, in that by the time they are large enough to pick their natural life is nearing its end. This indicates that the tree carrying this fruit has not sufficient vigour to develop it all satisfactorily. The remedy, therefore, is to reduce the amount of fruit the tree is carrying by the judicious pruning mentioned above, with particular attention to eliminating "branch-rubs." Attention should also be paid to manurial and soil-condition requirements and if necessary to the control of disease.

Green-spot is a condition which causes a considerable lowering of the grade of lemons during several months of the autumn–winter period. The primary cause is bruising, brought about by rough handling of the fruit at some period during transit from tree to curing-room. The bruises are not very noticeable in the early stages, but show up after colouring. As the result of the bumps which they receive, the oil-cells at the point of impact are fractured and oil flows on to the surface of the rind, which at this point shrinks slightly, thus causing the oil-cells to stand out more prominently. If oil from a bruised lemon makes contact with an undamaged one, it causes a green spot at that point. Thus the number of lower-grade fruit is accentuated. As the typical green-spot does not show up until after the lemons have been in the colouring-room, the grower who supplies a central depot does not see the damage, a percentage of which happens in the orchard. Green-spot occurs most often when the fruit being picked is dark green. At this stage the rind is very tender and thus liable to damage. Later on when the bulk of the fruit coming up to correct size is silver or coloured the rind has toughened considerably. Although growers at all times should take great care in handling the fruit, one would like to emphasize the point that during the next few months, when large quantities of "dark greens" will be handled, even greater care should be taken to prevent blemishes due to rough handling.

Warning.—Growers generally are aware of the standard spraying practices and of the specifics which may be applied with safety in the working of their groves. In spite of this, new and sometimes ancient ones are being tried, some of which may be good while others may be harmful. It is in keeping with the progressive spirit of the age for one to make experiments in the orchard, but they should be carried out only in a very small way until these new practices have been proved safe and worthy of adoption on a large scale. Recently instances of severe loss have occurred in both young and old groves through the indiscriminate use of materials which have been harmful to the trees. Safety is the best policy where one's livelihood and capital are at stake.

—A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Selecting Breeding-stock.

THE most important work of the year on all commercial poultry-farms is the selection of the breeding-stock for the coming season. If this work has not already been done no time should be lost in giving it the very best possible attention. So important is this work that no poultry-keeper can afford to miss any opportunity of making the very best possible job of selecting his breeding-birds. If this work is put off much longer it will be impossible to select all the best birds, as once a bird starts to shed its feathers those points which go to indicate usefulness mostly disappear.

The difference between the cost of production and the price received for poultry-products is often such that mistakes made with the selection of the breeding-stock may easily mean that the poultry-keeping may show a loss instead of a profit.

Disease is causing many poultry-keepers much concern, and unfortunately some have experienced considerable losses. Those poultry-keepers should take extra care in the selection of their breeding-birds. Quality not quantity should be the aim, and only the very best birds having good constitution should be selected. If this is done it will be found that the resistance of the young stock will be such that disease will have little dread for them. In fact, it may be said that the whole future of the poultry industry depends very largely upon the care taken and the skill shown by poultry-keepers in the selection of their breeding-birds.

The novice who has had little experience in the art of selection should endeavour to get some practical lessons from a successful person and then try his hand at selecting from his own flock those birds which he considers will make suitable breeders. After he has made his own selection he would be wise to get some experienced person to check over his work, point out where mistakes may have been made, and how improvements could be effected. The successful breeder or selector has not only the ability to more or less correctly gauge the value of the visible characteristics of his birds, but by years of careful selection and a constant study of the individuals of his flock he places himself in the best possible position when selecting his breeders to guard against those undesirable invisible characteristics which so often have such a disappointing influence on the progeny.

It is well to remember always that each bird possesses not only visible but numerous invisible characteristics, which may be transmitted to the offspring, and unless the selector has some knowledge of the pedigree of the stock he is selecting he is, to a certain extent, working in the dark.

A pure line of descent from parents that have been carefully selected for constitution, production, and breed characteristics is what is required. Every healthy purebred bird is capable of transmitting certain characteristics of its breed to its offspring, and the longer and more carefully the breeding-birds have been selected the more likely are those transmitted characteristics to be favourable. While a pure line or pedigree strain is so desirable, the great value and importance of individuality should never be underestimated. This point is mentioned because many beginners' plants have been visited where certain birds have been used as breeders just because they were brothers or sisters to certain competition or show winners. The results from such birds have, at times, been most disappointing, because they lacked that individuality or make-up of visible characteristics which is so necessary in a breeding-bird.

It is true that the secrets of heredity are, so far,-well guarded, but there are some people who by a careful study of a particular breed and an almost uncanny ability or "gift" of selecting can detect those birds which have, in a marked degree, the power of transmitting good characteristics to their offspring.

These people have a natural genius in that particular line, and have by their natural ability been able to build up such a name for their stock that it is keenly sought after owing to its general high quality.

If it were possible for those of little experience or those who have had trouble with their birds to engage one of those "gifted" selectors to pick out their breeding-birds and only breed from such birds, it would be the very best way of guarding against disease and maintaining the good name this country has for utility stock. Though all poultry-keepers are not likely to become outstanding in the art of selection, as the natural aptitude for the work is possessed by few, still it is well for beginners to bear in mind that the art of selection can be cultivated, and if one is an enthusiast and is a keen observer he will soon find that those, together with a little practical experience, will enable him to make a very fair job of selecting his own breeding-birds.

The chief essential characteristics required in a good breeding-bird are purity of blood, vigour, constitution, and capacity to produce and reproduce.

The first step a poultry-keeper should take in order to become a successful selector and builder of a high-class strain or flock of utility birds is to acquire a knowledge of the standard requirements for the particular breed he intends keeping, for unless one has some definite standard to guide him much permanent improvement can hardly be expected. Like the carpenter who is asked to build a certain style of house, he must have plans and specifications to guide him.

The second step should be, when selecting, to heed that principle "like produces like," and always select those birds which show characters nearest

to the model aimed at, for it is a fact that the offspring from purebred birds of the same breed are more likely to possess characteristics like their parents than those of other birds.

No doubt at times variations will cause disappointments, but all successful breeders have experienced such setbacks, but they are never discouraged by a few disappointments. It is really these numerous variations and more or less individual differences which do crop up that make the great art of selecting so difficult yet so wonderfully interesting.

The third matter, and perhaps the most important when it comes to actual picking of the breeders, is the body—its size, strength, and shape. Just as the life of any structure depends largely upon the strength of its foundations and frame, so also does the life and usefulness of a strain or family of birds depend upon the strength, type, and size of its individual members.

There is a tendency with some to place too little value on body-size, and rather too much on egg-records. While it is true that the medium-sized bird is often the better layer, it is well to remember that experience has proved that the best breeders are as a rule a little larger than the best layers, and that smallness is not the cause of great egg-production, but its effect.

At times some are inclined to be influenced too much by a nice comb or lobes, and, while it is most desirable to breed birds as near to the standard as possible, it is well to remember that the body is where the eggs come from, while the comb and lobes are furnishings.

It will prove better financially and otherwise to first pay the extra attention to the developing of good bodies rather than to developing good combs and lobes on poorer bodies.

The chief visible characteristics of a good utility bird are: Body will show length, depth, and width; a good crop-capacity and depth of abdomen; back rather flat, with width carried well back to the tail; the texture of the abdomen should be fine, silky, and flexible (a most important point); legs of medium length carried well back and wide apart; head fairly fine, showing strength and character, not coarse, but rather wide at the top, and of fair length; comb of medium size and thickness, not too small and not coarse or flabby; wattles of medium size, fine in texture, and carried close together; feathering hard, tight, dense, and often of a worn threadbare appearance at this time of the year; eyes large, bold, and prominent.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Autumn Management.

In case all surplus honey has not been removed by the time these notes appear, beekeepers would be well advised to use bee-escapes, as indicated in last month's notes. There is a grave risk of starting robbing unless extreme care is exercised in removing honey so late in the season. However, the use of bee-escapes, with ordinary care, will enable his operations to be completed in comfort and without the interference of robber bees, which are particularly active at the close of the flow.

In some districts after the autumn rains a small flow of honey may be experienced, sufficient to meet the daily needs of the colony, with some to store for winter food. It is well, however, to make sure that the colonies have a sufficient supply of honey on hand to winter well; thus an estimate of stores should be made when the remainder of the surplus is taken. In most districts it is good practice to leave not less than 40 lb. of honey for each colony's requirements, while in some districts 60 lb. would be a safer estimate. It must be remembered that it is in autumn the beekeeper is

laying the foundation for the next season's crop; therefore he should concentrate in wintering his bees well. The three main factors to be observed are strong colonies, abundance of stores, and queen-right hives.

As the season advances supers not fully occupied by the bees should be removed and stored away.

Uniting Colonies.

As advised last month, all weak and queenless hives should be united. The golden rule of modern beekeeping is to keep all colonies strong, and this applies specially to the autumn months, when weak colonies are in danger of being robbed. If by any chance late swarming and weak colonies from defective queens have to be dealt with, the procedure recommended is as follows: After taking the roof and mat from a queen-right hive, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. Little smoke will be required if the colony is gently handled. Weak colonies should be similarly treated. There is no need to remove one of the queens, as the bees will decide which they will keep.

Robbing.

Robbing is the result of carelessness, and once it has started is exceedingly hard to check. Do not expose honey, sugar, syrup, or anything that the bees can rob. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive entrances, and especially guard against leaving hives open in a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing, but where a colony has been overpowered by the robbers it should be closed altogether.

Care of Extracting-combs.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house, it is far better that they should be stored in the hives. If the latter plan is adopted the mats must be placed on top of the brood-chamber, and the supers "tiered" above the mats. Unless the apiary is well sheltered, however, the hives must be weighted, as the winter gales will easily overset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs should be properly housed to secure them from destruction by mice and wax-moths. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs. The price of foundation now ruling is making it far more costly to produce combs, and if large numbers have to be annually produced the renewals become a severe tax on the season's profits.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working-season that the beekeeper realizes the value of combs in securing a crop. A shortage of combs during the flow often prevents the bees being kept in working-trim, and leads to the production of honey being greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees.

In the absence of a mouse-proof room the combs can be stacked in supers "tiered" one above another. Be sure that there are no holes or cracks in the supers through which the mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying the combs during the off-season. Should the wax-moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better when storing the combs at the end of the season to place a few moth-balls among them. This will be sufficient to prevent the attack of the moths.

Care of Equipment.

As soon as the honey has been disposed of, all utensils used in handling the crop should be thoroughly cleaned. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully with boiling water, and dry thoroughly to prevent rusting. The high cost of equipment should impel the beekeeper to take great care in storing his plant during the off-season. It is advantageous to use loose washing-covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE

Vegetable Crops.

ONE of the modern problems in vegetable-growing is the maintenance of a sufficient supply of humus in the soil under a system of constant and intensive cropping. In the past this has been done satisfactorily by applying heavy dressings of stable manure at suitable intervals. Such supplies are now not available, and, where no effective substitute is used the soil becomes, more or less, a dry lifeless dust, or, in wet weather, a sticky paste in which good crops may not be grown even with the most generous and well-considered mixture of artificial fertilizers. Even on the farm, in the warmer districts especially, little or no stabling is done, and well-cured animal manures for this purpose are scarce. On the lighter soils the problem of maintaining fertility is often best met by sowing down the land in grass and clovers, and grazing it for three years before breaking it up again for cropping for a similar period. On limited areas of high-priced heavy land this solution is not acceptable, and the question remains as to how this demand can best be met.

Where the land is adjacent to a sea-beach where seaweed sometimes accumulates, that material should be used, as its value for the purpose is comparable with stable manure. Unless, however, it is conveniently placed the cost of collection and carting may render this supply uneconomical. Poultry-keeping is sometimes practised partly with the object of obtaining a supply of manure, and the method is always worthy of consideration. In very many cases the supply of humus has to be maintained by means of an inadequate supply of farm and stable manure supplemented by grass and other vegetation which may be harvested in the vicinity and fermented down, together with such green crops as may be grown on the land and turned under.

To make a compost heap of the class referred to, select a situation that is inclined to be humid rather than dry, and remove about 1 ft. of soil from

a strip about 8 ft. wide and as long as desirable, placing the soil equally along each side. In the strip so cleared build the stack about 5 ft. or 6 ft. high as the material becomes available. Any vegetable or animal material that will decay in a few months is suitable. Build the stack firmly with straight perpendicular sides and "damp down" any dry material. Fermentation will soon commence, and the temperature will be sufficiently high to destroy most injurious organisms. Top off the stack with grass and weeds mown before they seed, during the month of December, in odd corners and headlands. Wet it as may be necessary, and then cover with the soil which was removed from the foundation. This may be kept in place by logs placed along the edge of the top of the stack and wired into position. When more material again commences to accumulate start another stack. If fermentation is slow an occasional dressing of sulphate of ammonia and phosphates will hasten it if the material is kept moist.

As the main crops are now cleared the portion of land selected for planting early crops during the months of July and August should receive a dressing of manure which is turned under. If 4 cwt. or so of basic slag or bonedust per acre and the same quantity of kainit are worked in afterwards, the land should be in good condition for planting out salad and other crops in early spring. The kainit has the additional advantage of destroying slugs and other insect pests which are often troublesome at that season.

The remaining land as it is cleared, and so much of it as is not required for immediate cropping, may be sown down in Algerian oats, 1½ bushels, and horse-beans, 1 bushel, per acre; or Cape or black barley and vetches in the same proportions. These hardy crops in most localities will make good growth during the winter months, when the land can best be spared from commercial cropping, and provide in roots and tops considerable humus in the land when turned under to decay before further planting is done. They also have a beneficial effect in crowding out weeds and so cleaning the land. Such land will usually be in good heart for the growth of these green crops, but consideration may be given to the application of a moderate dressing of fertilizers with a view to obtaining maximum growth. On small areas white mustard is sometimes sown. The crop is comparatively light, but still useful: it suppresses weeds and helps to prevent the waste of nitrates which may otherwise be washed away if the land is left bare. It may be sown at a rate of about 2 oz. per square rod.

The tomato crop at this season is often slow in colouring owing to low temperatures. If mature fruit is placed in a temperature of 65° to 75° F. before or after packing it will redden perfectly. In a temperature over 80° red colouring is retarded. Light is not a factor in the operation.

Mushroom-culture has made considerable progress here recently. Beds 9 in. deep in sheds have given best results, and are also most economical with the limited supply of stable manure which is available. The main difficulty has been the control of extreme temperatures in summer and winter. To some extent it has been met by covering the beds with dry straw, but this method is inconvenient, especially where the beds are built in tiers to economize space. A well-built, insulated, and properly ventilated shed is no doubt the solution to this difficulty. It also facilitates the control of insect pests, &c., by permitting effective fumigation and excluding much reinfection if the ventilators are screened. Continuous cropping can only be maintained where the conditions are under control and scrupulous cleanliness is observed in all of the operations.

In a piece of clean, well-drained land the spring cabbage crop is now planted out. The plants should be set well down to the first leaves and the soil carefully firmed about the roots, especially when using a dibber.

Cabbage, cauliflower, and lettuce plants are often sown during the month of April for planting out in early spring. In the cooler districts the protection of a cold frame is required.

Small-fruits and Sundry Crops.

Trials of varieties of hardy fruits for commercial purposes were started at the Wisley Gardens of the Royal Horticultural Society, England, in 1922, under the administration of a representative committee, and examined at intervals by appointed judges. The most promising varieties were given a further test at sub-stations throughout the country. The first report was made in 1932, and the following are some of the outstanding results :—

Black Currants.—The position held by the four standard varieties (in order of ripening), Boskoop Giant, Seabrook's Black, Goliath, and Baldwin, is not immediately challenged. Daniels September is quite the best late-ripening currant, and in some districts may rival Baldwin.

Raspberries.—The three most satisfactory varieties in the trials were Lloyd George, Red Cross, and Pyne's Royal, with Norfolk Giant as the most promising late variety.

Red Currants. — Earliest of Fourlands, Laxton No. 1, and Perfection were the best of a moderate entry.

Gooseberries.—Leveller and Lancashire Lad are the standard varieties. Many entries were planted late and were not sufficiently established for judging commercial qualities at the time of the report. Leveller is a fairly vigorous plant of spreading habit, with large oval dessert fruit, yellow-green in colour, and practically smooth surface. A heavy cropper and excellent quality. Lancashire Lad is a large oval culinary fruit, dark red, with hairy surface when ripe, but useful for harvesting in green state. Growth upright in habit ; a heavy bearer.

Raspberry Lloyd George has been planted in many parts of the North Island, and has given great satisfaction, looking very much as if its triumphs elsewhere were to be repeated here. But it cannot be too strongly stressed that commercial plantings should be done only with varieties of small fruits that have been proved suitable for one's locality and market. The above lists, however, contain interesting suggestions for further trials in localities where fruit of this class is grown.

Crops of this class, harvested as they are about mid-summer, require a moist, well-drained soil for commercial cropping, gooseberries and red currants being to some extent exceptions. A somewhat open situation is also desirable, but in this respect black currants are the least particular.

The preparation of the land should now be completed as soon as possible, so that it may settle down well before planting commences. A generous dressing of manure, including perhaps blood and bone manure, trenched in or double-ploughed, will be suitable. When these crops are established only shallow ploughing and cultivation can be done without serious injury to the crop.

As regards spacing, much depends on the quality of the soil and the vigour of the varieties planted. Usually the distance between rows is 5 ft. to 6 ft., but in extreme cases 7 ft. to 8 ft., more especially for large plantations where the bigger implements are used. The tendency of late years has been to close up the distance between plants. Raspberries are often planted singly 1½ ft. to 2½ ft. apart in the row, and black currants 3 ft. For the first season or two the dwarfer vegetable crops can be grown in the alleys if first care is given to the welfare of the permanent crop.

On the farm a special area should be devoted to these crops with a view to providing supplies for the household. It would be most convenient if other permanent crops such as asparagus and rhubarb, also culinary herbs, &c., could be included. In this way the needs of the crops are best supplied, and the management is most economical.

Where nuts are grown the grass under the trees should be mown, or the surface otherwise smoothed out in the most suitable manner to facilitate harvesting. Then as soon as the nuts are ripe the trees should be well shaken and the nuts gathered, repeating the operation at intervals as may be necessary. Leaving the nuts on the ground exposed to dews and rain

for but a short period depreciates the appearance and quality. Even when gathered promptly the nuts should be cured by drying them off well before storage. This is done in a well-ventilated shed or in the open, the nuts being placed in trays 6 in. or so deep with slatted bottoms, and well stirred from time to time. If curing is done outside, the trays should be stacked and covered at night to keep them dry. When cured the nuts should be put over a riddle to eliminate waste and under-sized specimens before marketing. Nuts required for planting should not be dried, but stratified in damp sand or sandy soil until they are sown.

The Homestead Garden.

In the flower-garden herbaceous plants now receive most consideration. Anemones, ranunculus, tulips, hyacinths, early-flowering gladiolus, are among the spring-flowering bulbous plants which are now set out; also wallflowers, polyanthus, pansies, &c., for a display at that season. These often take the place of summer-flowering annuals which are now going off. Sweet peas and other hardy annuals for spring flowering may be sown; also additions and alterations may be made to perennial herbaceous borders. The present time, indeed, is suitable for the periodical overhaul which is required to keep the herbaceous border in first-class condition, or that operation may be deferred until early spring.

In new gardens where the borders after subsoiling or trenching have been given shallow cultivation for a few weeks to destroy the crop of weed-seeds sufficiently near the surface for germination, and allow the ground to settle, herbaceous plants may now be set out. The effect is generally best when the group of plants of each variety is rather large. Border carnations deserve special consideration for this work in seaside gardens. In a well-drained open situation they flourish amazingly and are attractive in every way—foliage and flowers, colour, and fragrance.

Autumn-sown lawns have had good rains, and should come away strongly. When the grass is an inch or two high it should be cut when dry with a lawn-mower which is well lubricated and carefully set. It is generally best at this stage to raise the knife as high as possible and set it evenly and firmly. If cutting is repeated when necessary the grasses stool out and a good turf becomes established before the winter season.

—W. C. Hyde, Horticulturist, Wellington.

DEPARTMENT OF AGRICULTURE.
WALLACEVILLE POULTRY STATION.

FOR SALE—

WHITE LEGHORN

COCKERELS, BREEDING HENS, and PULLETS.

Also,

Now booking orders for **EGGS and DAY-OLD CHICKS.**

For full particulars apply—
THE POULTRY OVERSEER,
Veterinary Laboratory,
Private Bag to Wallaceville,
WELLINGTON.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MORTALITY IN EWES AND LAMBS.

O. J., Apiti :—

I lose annually approximately 6 per cent. of my ewes before lambing with what I think is sleepy sickness and paralysis. Some also die without showing any symptoms of sickness at all. About 10 per cent. of the lambs are still-born or die shortly after birth. The balance of the lambs are very healthy, and fatten as well as any in this district. My farm is located in a cold district with very severe frosts, and the grass-growth in winter is very slight. I grow swedes and chou moellier for supplementary feed.

The Live-stock Division :—

An adequate feed-supply for your ewe flock during the winter months in your district is the most important factor in preventing the losses in the ewes at lambing, and also in ensuring the birth of healthy, strong lambs. It may be possible that a certain number of the ewes have not sufficient milk for the lambs at birth, and this may account for the main part of the 10 per cent. of lambs which die shortly after birth. In your locality I would suggest the continuation of your practice of providing swedes and chou moellier for winter feed, and, if possible, supplementing this with silage or hay if this is practicable.

CALVARY CLOVER.

W. F. S., Carterton :—

Which clover is "Calvary clover"? Is it found in New Zealand?

The Fields Division :—

Plants of white clover occasionally show red and reddish-brown blotches or markings on the leaflets, and sometimes patches of white clover so marked make their appearance in a pasture. These red markings were attributed to white-clover plants splashed with blood on Calvary it being held that the marks have become characteristic of white-clover plants descended from the original ones. The name "Calvary clover" has persisted. White clover with such markings, growing in patches, is not uncommon in New Zealand.

THRIPS ATTACKING COCKSFOOT.

G. H. V., Banks Peninsula :—

What is the nature and the control of the thrips attacking cocksfoot?

The Fields Division :—

The life-cycle of thrips commences in the egg stage. The eggs are laid either on the surface of the host plant or are inserted into the tissue by means of a sharp saw-like ovipositor. Following the egg stage there commonly are two larval stages, both of which bear a strong resemblance to the adult form in general appearance. A prepupal and a pupal stage follow next, during which time the animal moves but little and takes no nourishment. From the pupal stage the adult insect finally emerges. The time taken in completing the life cycle varies considerably for different species, and is also strongly influenced by temperature conditions.

The food of thrips consists of plant-juices obtained by breaking open the plant-cells by means of a chafing and rubbing action on the leaf or fruit surface and sucking the liquid contents with the cone-shaped mouth. In severe attacks the foliage becomes brown, dry, and brittle, and soon dies, the plants experience a severe set-back, and there is often a considerable reduction in production. Under field conditions control methods are largely lacking, but heavy rain is considered the best natural check.

WEATHER RECORDS: FEBRUARY, 1937.

Dominion Meteorological Office.

NOTES FOR FEBRUARY.

THOUGH there were no very violent storms, the weather during February was unsettled and very cold for the time of year. The total rain was much below normal in the northern and eastern portions of the North Island, but there was sufficient in most places to keep the soil moist. In Hawke's Bay and the Gisborne district, however, the westerly winds accentuated the rainfall failure, and dry conditions prevailed. Stock are generally in good condition, but have done rather better in the areas where the rainfall was low than elsewhere. It was too cold for animals really to thrive well, and in much of the South Island the softness of the feed has led to various digestive troubles and considerable losses of lambs. The milk-yield is being well maintained. In Taranaki and the Manawatu the heavy rains were confined, principally, to a few days towards the end of the month, but in the South Island they began earlier and produced adverse conditions for harvesting, which has been delayed somewhat. In parts of Canterbury there are signs of sprouting of wheat in some of the crops. Several frosts were experienced, and these, combined with the general lack of warmth, were unfavourable to many small crops. Tomatoes, in particular, have suffered considerably. There is still an abundance of pasture, and supplies of winter feed are assured for most districts.

Rainfall.—In Taranaki, western Wellington, and the whole of the South Island with the exception of a portion of North Canterbury, the month was a very wet one indeed. Most of Taranaki and Nelson had between two and three times the normal rainfall, while in parts of Otago and Southland even greater departures were experienced. Hawke's Bay and much the greater part of the Auckland Province had very low totals. In the Wairarapa conditions were more varied, but the departures from average generally small.

Temperatures.—The month was one of the coldest Februaries as yet experienced. Mean temperatures were everywhere much below normal, the departures increasing from about 2 degrees in the far North to about 4 at Wellington and over most of the South Island.

Sunshine.—At most places there was less sunshine than usual, though where the rainfall was below average the sunshine differed little therefrom. Tauranga had 220·1 hours and Napier and Lake Tekapo each 218·8.

Pressure Systems.—The month began with a fine spell while an anticyclone passed slowly eastwards across the country. From the 6th to the 8th there came a series of westerly depressions, the effects of which were felt mainly in the South Island, heavy rain falling in western and southern districts. After a very brief interval a fresh and a very long series began to pass. As the first of these depressions, a rather intense one, approached on the 10th, north-westerly gales occurred in the middle portion of the Dominion. By the 11th winds had changed to west or south-west, and from that date until the 18th the winds from these directions continued to prevail, and were frequently strong. General rains occurred, with heavy falls over the South Island and about Wellington. From the 10th to the 14th the atmosphere was particularly unstable, and thunder and hailstorms were very numerous. Snow fell on the ranges, and there were a number of frosts during the period.

A fine spell followed, and the anticyclone previously mentioned finally moved eastward across the Tasman Sea and the Dominion. On the 23rd, however, another unsettled spell commenced. Again there was general rain, with very heavy falls from Taranaki southwards. Flooding occurred in Taranaki, western Wellington, the Waimakariri River, and in Otago and Southland.

Rainfalls for February, 1937, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Fall.	Total Rainfall to Date.	Average Rainfall to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	4·00	14	1·06	3·50	12·47	7·44
Russell	0·84	4	0·41	4·24	17·94	8·33
Whangarei	1·65	10	0·54	3·87	12·29	7·80
Auckland	1·05	9	0·38	3·57	5·46	6·54
Hamilton	1·82	10	0·49	2·91	7·10	6·48
Rotorua	1·89	12	0·62	3·84	8·50	7·95
Kawhia	..	..	..	2·86	..	6·41
New Plymouth ..	11·24	14	4·64	3·94	15·48	8·12
Riversdale, Inglewood ..	17·01	15	5·53	6·03	24·98	13·54
Whangamomona ..	10·82	8	4·92	3·89	16·02	9·47
Hawera	7·12	12	2·40	2·40	10·20	5·91
Tairua	0·96	9	0·17	4·68	7·24	8·34
Tauranga	1·20	11	0·41	3·78	6·58	7·81
Maraehako Station, Opotiki	1·15	11	0·30	4·14	11·58	7·73
Gisborne	0·73	6	0·37	2·46	5·88	6·18
Taupo	1·28	9	0·50	3·74	5·90	6·11
Napier	0·72	5	0·39	2·46	5·41	4·96
Hastings	0·11	5	0·04	2·25	3·12	4·18
Whakarara Station ..	0·91	7	0·20	..	7·20	..
Taihape	2·35	10	0·41	2·43	6·56	5·59
Masterton	2·76	13	0·87	2·78	6·90	5·34
Patea	6·83	11	1·86	2·40	10·90	5·99
Wanganui	5·23	9	1·35	2·42	8·46	5·25
Foxton	3·78	9	1·05	2·07	6·02	4·21
Wellington	4·22	11	0·99	2·75	7·40	5·64
	South Island.					
Westport	10·72	17	1·67	5·35	19·65	13·55
Greymouth	11·00	18	2·10	6·21	26·30	15·38
Hokitika	13·84	16	3·42	7·22	28·20	17·32
Ross	14·16	16	4·05	8·90	34·65	21·30
Arthur's Pass	18·86	15	7·03	9·90	39·11	24·02
Okuru, South Westland	10·19	9	3·50	9·66	24·71	22·25
Collingwood	10·90	11	2·89	5·13	20·33	11·71
Nelson	5·43	11	2·83	2·63	7·52	5·53
Spring Creek, Blenheim	3·38	10	1·20	2·18	7·03	4·40
Seddon	2·10	8	0·72	1·85	5·69	3·69
Hanmer Springs ..	2·53	13	0·65	3·26	4·57	7·21
Highfield, Waiau ..	1·49	10	0·45	2·60	2·58	5·58
Gore Bay	2·26	12	0·76	2·80	3·56	5·26
Christchurch	2·19	16	0·76	1·56	4·27	3·89
Timaru	2·48	13	0·85	1·79	6·18	4·18
Lambrook Station, Fairlie	2·80	11	0·70	1·81	6·28	4·24
Benmore Station, Clearburn	2·73	11	0·61	1·62	8·23	4·39
Oamaru	2·13	12	0·78	1·79	4·40	3·83
Queenstown	3·78	12	1·39	1·97	7·64	4·84
Clyde	2·68	10	1·26	1·06	4·28	2·91
Dunedin	7·15	16	2·02	2·71	10·46	6·12
Wendon	7·56	20	2·09	2·26	12·46	5·46
Balclutha	6·78	19	1·84	1·99	9·13	4·30
Invercargill	5·88	21	1·35	3·18	19·26	7·18
Puysegur Point ..	12·68	21	2·50	5·74	29·57	13·36
Half-moon Bay ..	5·54	18	0·69	4·08	12·75	8·90